Nokia Customer Care

Service Manual

RM-505; RM-506 (Nokia N97; L3&4)

Mobile Terminal

Part No: (Issue 1)

COMPANY CONFIDENTIAL

NOKIA
Care

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Amendment Record Sheet

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IMPORTANT

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Warnings and cautions

Warnings

- IF THE DEVICE CAN BE INSTALLED IN A VEHICLE, CARE MUST BE TAKEN ON INSTALLATION IN VEHICLES FITTED WITH ELECTRONIC ENGINE MANAGEMENT SYSTEMS AND ANTI-SKID BRAKING SYSTEMS. UNDER CERTAIN FAULT CONDITIONS, EMITTED RF ENERGY CAN AFFECT THEIR OPERATION. IF NECESSARY, CONSULT THE VEHICLE DEALER/ MANUFACTURER TO DETERMINE THE IMMUNITY OF VEHICLE ELECTRONIC SYSTEMS TO RF ENERGY.
- THE PRODUCT MUST NOT BE OPERATED IN AREAS LIKELY TO CONTAIN POTENTIALLY EXPLOSIVE ATMOSPHERES, FOR EXAMPLE, PETROL STATIONS (SERVICE STATIONS), BLASTING AREAS ETC.
- OPERATION OF ANY RADIO TRANSMITTING EQUIPMENT, INCLUDING CELLULAR TELEPHONES, MAY INTERFERE WITH THE FUNCTIONALITY OF INADEQUATELY PROTECTED MEDICAL DEVICES. CONSULT A PHYSICIAN OR THE MANUFACTURER OF THE MEDICAL DEVICE IF YOU HAVE ANY QUESTIONS. OTHER ELECTRONIC EQUIPMENT MAY ALSO BE SUBJECT TO INTERFERENCE.
- BEFORE MAKING ANY TEST CONNECTIONS, MAKE SURE YOU HAVE SWITCHED OFF ALL EQUIPMENT.

Cautions

- Servicing and alignment must be undertaken by qualified personnel only.
- Ensure all work is carried out at an anti-static workstation and that an anti-static wrist strap is worn.
- Ensure solder, wire, or foreign matter does not enter the telephone as damage may result.
- Use only approved components as specified in the parts list.
- Ensure all components, modules, screws and insulators are correctly re-fitted after servicing and alignment.
- Ensure all cables and wires are repositioned correctly.
- Never test a mobile phone WCDMA transmitter with full Tx power, if there is no possibility to perform the measurements in a good performance RF-shielded room. Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.
- During testing never activate the GSM or WCDMA transmitter without a proper antenna load, otherwise GSM or WCDMA PA may be damaged.

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ESD protection

Nokia requires that service points have sufficient ESD protection (against static electricity) when servicing the phone.

Any product of which the covers are removed must be handled with ESD protection. The SIM card can be replaced without ESD protection if the product is otherwise ready for use.

To replace the covers ESD protection must be applied.

All electronic parts of the product are susceptible to ESD. Resistors, too, can be damaged by static electricity discharge.

All ESD sensitive parts must be packed in metallized protective bags during shipping and handling outside any ESD Protected Area (EPA).

Every repair action involving opening the product or handling the product components must be done under ESD protection.

ESD protected spare part packages MUST NOT be opened/closed out of an ESD Protected Area.

For more information and local requirements about ESD protection and ESD Protected Area, contact your local Nokia After Market Services representative.

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Care and maintenance

This product is of superior design and craftsmanship and should be treated with care. The suggestions below will help you to fulfil any warranty obligations and to enjoy this product for many years.

- Keep the phone and all its parts and accessories out of the reach of small children.
- Keep the phone dry. Precipitation, humidity and all types of liquids or moisture can contain minerals that will corrode electronic circuits.
- Do not use or store the phone in dusty, dirty areas. Its moving parts can be damaged.
- Do not store the phone in hot areas. High temperatures can shorten the life of electronic devices, damage batteries, and warp or melt certain plastics.
- Do not store the phone in cold areas. When it warms up (to its normal temperature), moisture can form inside, which may damage electronic circuit boards.
- Do not drop, knock or shake the phone. Rough handling can break internal circuit boards.
- Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the phone.
- Do not paint the phone. Paint can clog the moving parts and prevent proper operation.
- Use only the supplied or an approved replacement antenna. Unauthorised antennas, modifications or attachments could damage the phone and may violate regulations governing radio devices.

All of the above suggestions apply equally to the product, battery, charger or any accessory.

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Company policy

Our policy is of continuous development; details of all technical modifications will be included with service bulletins.

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- Latest Amendment Number (if applicable)
- Page(s) and/or Figure(s) in error

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Battery information

Note: A new battery's full performance is achieved only after two or three complete charge and discharge cycles!

The battery can be charged and discharged hundreds of times but it will eventually wear out. When the operating time (talk-time and standby time) is noticeably shorter than normal, it is time to buy a new battery.

Use only batteries approved by the phone manufacturer and recharge the battery only with the chargers approved by the manufacturer. Unplug the charger when not in use. Do not leave the battery connected to a charger for longer than a week, since overcharging may shorten its lifetime. If left unused a fully charged battery will discharge itself over time.

Temperature extremes can affect the ability of your battery to charge.

For good operation times with Li-Pol batteries, discharge the battery from time to time by leaving the product switched on until it turns itself off (or by using the battery discharge facility of any approved accessory available for the product). Do not attempt to discharge the battery by any other means.

Use the battery only for its intended purpose.

Never use any charger or battery which is damaged.

Do not short-circuit the battery. Accidental short-circuiting can occur when a metallic object (coin, clip or pen) causes direct connection of the + and - terminals of the battery (metal strips on the battery) for example when you carry a spare battery in your pocket or purse. Short-circuiting the terminals may damage the battery or the connecting object.

Leaving the battery in hot or cold places, such as in a closed car in summer or winter conditions, will reduce the capacity and lifetime of the battery. Always try to keep the battery between 15°C and 25°C (59°F and 77°F). A phone with a hot or cold battery may temporarily not work, even when the battery is fully charged. Batteries' performance is particularly limited in temperatures well below freezing.

Do not dispose of batteries in a fire!

Dispose of batteries according to local regulations (e.g. recycling). Do not dispose as household waste.

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Nokia N97; L3&4 Service Manual Structure

1 General Information
2 Service Tools and Service Concepts
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4 RF Troubleshooting
5 Camera Module Troubleshooting
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7 FMTx 2.1 Troubleshooting
8 System Module and User Interface
9 Service information differences between RM-505 and RM-506
Glossary

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1 — General Information

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Product selection

RM-505 is a GSM/HSDPA/WCDMA tri-mode handportable multimedia computer with a person centric touch UI, integrated GPS (A-GPS OMA SUPL) and WLAN. It supports EGSM 850/900/1800/1900 and WCDMA 900/1900/2100 bands. RM-507 supports GSM/GPRS/EGPRS850/900/1800/1900, with WCDMA 850/ 1900/2100 HSDPA and WLAN. Both devices support CSD/HSCSD, GPRS/EGPRS, WCDMA/HSDPA data bearers.

For WCDMA the maximum bit rate is up to 384 kbit/s for downlink and 384 kbit/s for uplink with simultaneous CS speech or CS video (max. 64 kbit/s). The HSDPA peak is 3.6 Mbit/s downlink (with limited use cases).

For 2G and 2.5G networks the device is a Class A EGPRS DTM MSC 11 which means a maximum download speed of up to 296kbit/s with EGPRS, and up to 107kbit/s with GPRS. According to GSM standard 05.05 it responds to class 4 (max. 2W) in GSM 850 and EGSM 900 class 1 (1W) in DCS 1800 and class 1 in PCS 1900. The device supports EGPRS (EDGE) class B as well as Bluetooth 2.0 + EDR standard.

The device has a large QHD 3.5”(640 x 360 pixels) colour display (active area 39.6 mm x 70.4 mm) with 16 million colors. It also has a 5 megapixel autofocus camera with 14 x digital zoom and an integrated dual LED flash. The device supports two way video calls with two integrated cameras, one on the front and one on the back.

The MMS implementation follows the OMA MMS standard release 1.3. The Browser is a highly advanced internet browser also capable of viewing operator domain XHTML Mobile Profile (MP) content.

The device uses a S60 5.0 operating system and supports the full Web Browser for S60, which brings desktop-like Web browsing experience to mobile devices. It also supports MIDP Java 2.0, providing a good platform for compelling 3rd party applications.

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Figure 1 View of RM-505/RM-506

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Product features and sales package

Imaging

Main camera:

- Sensor: 5 megapixel
- Carl Zeiss Optics: Tessar™ lens
- F number/Aperture: F2.8
- Focal length: 5.4 mm
- Focus range: 10 cm ~ infinity
- Macro focus distance: 10-50 cm
- Shutter speed: Mechanical shutter 1/1000~1/4 s

Secondary camera:

- Sensor: VGA (640 x 480 pixels)
- F number/Aperture: F2.8
- Focal length: 43 mm (35mm equivalent)
- Focus range: 10 cm ~ infinity

Video:

- Video resolution: QHD or VGA at 30 fps
- Audio recording: AAC (AMR for MMS)
- Video stabilization
- Video clip length: 60 min
- Video file format: .mp4 (default), .3gp (for MMS)
- White balance: automatic, sunny, cloudy, incandescent, fluorescent
- Scene: Auto, Night
- Colour tone: normal, sepia, B&W, vivid, negative
- Zoom (digital): up to 14x
- Video recording indicato

Photo:

- Still image resolutions: up to 5 megapixel: 2584 x 1938
- Still image file format: JPEG/EXIF
- Auto focus
- Auto exposure: center weighted AE
- Image orientation: automatic
- Exposure compensation: +2 ~ -2EV at 0.5 step
- White balance: automatic, sunny, cloudy, incandescent, fluorescent
- Scene: auto, sports, portrait, close-up, landscape, night, user defined
- Colour tone: normal, sepia, B&W, vivid, negative
- Zoom (digital): up to 14x
- LED flash

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Edit

- On device Photo editor and Video editor (manual & automatic)

View

- 3.5" QHD (640 x 360 pixels) colour display (active area 39.6 mm x 70.4 mm), up to 16M colors, 16:9 aspect ratio
- Digital Ambient Light Sensor (ALS) – used to optimize display/key brightness and power consumption
- Slideshow from Gallery

Share

- Nokia XpressShare - share effortlessly from Gallery or after capture via Email, Bluetooth or MMS
- Direct connection to TV via cable or WLAN (UPnP)
- Video call and video sharing support. (WCDMA services)
- Online Album: Image/Video uploading from Gallery

Print

- Nokia XpressPrint – direct printing via USB (PictBridge), Bluetooth (BPP), and WLAN (UPnP), from memory card or via online printing

Store

- Up to 32GB internal user memory
- Nokia XpressTransfer – easy to transfer and organize photos and video between your device and a compatible PC
- Nokia Lifeblog (mobile & PC)

Music

- Digital music player: supports MP3/ AAC/ AAC+/ eAAC+/ WMA with playlists, equalizer and album art.
- Synchronise music with Microsoft Windows Media Player 10 & 11
- One click CD ripping, converting and transferring music to your device using Nokia Music Manager
- Stereo FM radio (87.5-108MHz /76-90MHz) with Visual Radio™ support
- Stereo speakers
- Integrated FM transmitter (88.1 – 107.9 MHz)
- Integrated handsfree speaker
- Nokia Stereo Headset (HS-45), in-box

Media

- Full-screen video playback to view downloaded, streamed or recorded video clips
- Supported video formats: MPEG-4 , H.264/AVC, H.263/3GPP, RealVideo 8/9/10

Productivity

Messaging:

- E-mail (SMTP, IMAP4, POP3), MMS, SMS

Office applications:

- Viewing of email attachments – .doc, .xls, .ppt, . pdf

PIM:

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- Contacts, calendar, to-do, notes, recorder, calculator, clock, converter

Synchronization:

- Local/Remote (using SyncML)
  - Data: Calendar, Contacts, To-do, Notes, E-mail
  - PC Applications: Microsoft Outlook (98, 2000, 2002, 2003), Outlook Express, Lotus Organizer (5.0, 6.0), Lotus Notes (5.0, 6.0)

Call management:

- Call logs, speed dial, voice dialling (with SIND) and voice commands
- Nokia Push to Talk (PoC)

Connectivity

- Integrated GPS (A-GPS OMA SUPL)
- WLAN - IEEE802.11 g/b with UPnP support
- Micro USB interface with USB 2.0 high speed
- Bluetooth wireless technology 2.0 + EDR + A2DP
- MicroSD memory card - support up to 16GB
- Nokia 3.5 mm AV connector

Add-on software framework

- Symbian 9.4 OS
- Nokia Series 60, 5th edition, feature pack 2
- Java: MIDP2.0
- C++ and Java SDKs

Additional technical specifications

- Vibrating alert
- 3GPP Rel 5/6 WCDMA , Rel 4 EGSM compliant
- Speech codecs supported in WCDMA: AMR
- Speech codecs supported in GSM: FR AMR/HR AMR/EFR/FR/HR
- WCDMA 2Mbps, HSDPA 7.2Mbps
- Dual Transfer Mode (DTM) support for simultaneous voice and packet data connection in GSM/EDGE networks. Simple class A, multi slot class 11, max speed DL/UL: 118.4/118.4kbits/s
- EGPRS class B, multi slot class 32, (5 Rx + 3 Tx / Max Sum 6), max speed DL/UL= 296 / 177.6 kbits/s
- GPRS class B, multi slot class 32 (5 Rx + 3 Tx / Max Sum 6), max speed DL/UL= 107 / 64.2 kbits/s

Sales package

- Transceiver RM-505 or RM-507
- Charger (AC-10)
- Battery (BP-4L)
- Music headset (HS-45/AD-54)
- Connectivity cable (CA-101)
- Video connectivity cable (CA-75U)
- CD-ROM

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- User Guide

Mobile enhancements

Table 1 Audio

Enhancement	Type
Music headset	HS-45 with AD-54 3.5mm stereo plug
Stereo headset	HS-16
	HS-43
Mini speakers	MD-6
	MD-8
Wireless loopset	LPS-5
Wired headsets	WH-201
	WH-205
	WH-500
	WH-502
	WH-600
	WH-700
	WH-701
	WH-800
	WH-900

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Enhancement	Type
Bluetooth headset	BH-101
	BH-102
	BH-103
	BH-104
	BH-209
	BH-212
	BH-213
	BH-214
	BH-215
	BH-216
	BH-504
	BH-604
	BH-605
	BH-606
	BH-607
	BH-703
	BH-704
	BH-804
	BH-900
	BH-902
	BH-903
	BH-904
	BH-905
	WH-201
	WH-205
	WH-500
	WH-502
	WH-600
	WH-700
	WH-701
	WH-800
	WH-900
Bluetooth speakers	MD-7W

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Table 2 Car

Enhancement	Type
Nokia Universal Mobile Holder	CR-99
Nokia Holder Easy Mount	HH-12
	HH-17
Wireless plug-in handsfree	HF-300
Speakerphone	HF-200
	HF-310
	HF-510
Car kit	CK-100
	CK-300
Display car kit	CK-600
Mobile charger	DC-6
	DC-10
	DC-11

Table 3 Data

Enhancement	Type
Connectivity cable	CA-101
	CA-126
Video connectivity cable	CA-75U
MicroSD card	MU-37, 2 GB
	MU-41, 4 GB
	MU-44, 16 GB
	MU-43, 8 GB
	MU-44 16GB

Table 4 Messaging

Enhancement	Type
Multimedia pocket keyboard	SU-XX
Other multimedia peripherals	SU-33W
Stylus	STYLUS PEN ASSY

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Table 5 Positioning

Enhancement	Type
Wireless GPS module	LD-4W
Home connectivity	HD-1

Table 6 Power

Enhancement	Type
Battery 1200mAh Li-ion	BP-4L
Travel charger	AC-6
	AC-10
Charger adapter	CA-146

Technical Specifications

Transceiver general specifications

Unit	Dimensions (L x W x T) (mm)	Weight (g)	Volume (cm^3)
Transceiver with BP-4L 1500mAh li-pol battery pack	117.2 x 55.3 x 18.25	150	

Main RF characteristics for GSM850/900/1800/1900 and WCDMA VIII/II/I phones

Parameter	Unit
Cellular system	GSM850, EGSM900, GSM1800/1900, WCDMA VIII (900), WCDMA II (1900) and WCDMA I (2100)
Rx frequency band	GSM850: 869 - 894 MHz
	EGSM900: 925 - 960 MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz
	WCDMA VIII (900): 925- 960 MHz
	WCDMA II (1900): 1930-1990MHz
	WCDMA I (2100): 2110 - 2170 MHz

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Parameter	Unit
Tx frequency band	GSM850: 824 - 849 MHz
	EGSM900: 880 - 915 MHz
	GSM1800: 1710 - 1785 MHz
	GSM1900: 1850 - 1910 MHz
	WCDMA VIII (900): 880 - 915 MHz
	WCDMA II (1900): 1850-1910MHz
	WCDMA I (2100): 1920 - 1980 MHz
Output power	GSM850: +5 ...+33dBm/3.2mW ... 2W
	GSM900: +5 ... +33dBm/3.2mW ... 2W
	GSM1800: +0 ... +30dBm/1.0mW ... 1W
	GSM1900: +0 ... +30dBm/1.0mW ... 1W
	WCDMA VIII (900): -50 ... +24 dBm/0.01µW ... 251.2mW
	WCDMA II (1900): -50 ... +24dBm/0.01µW ... 251.2mW
	WCDMA I (2100): -50 ... +24 dBm/0.01µW ... 251.2mW
EDGE output power	EDGE850: +5 ... +29dBm/3.2mW ... 794mW
	EDGE900: +5 ... +29dBm/3.2mW ... 794mW
	EDGE1800: +0 ... +26dBm/1.0mW ... 400mW
	EDGE1900:+0 ... +26dBm/1.0mW ... 400mW
Number of RF channels	GSM850: 124
	GSM900: 174
	GSM1800: 374
	GSM1900: 299
	WCDMA VIII (900): 152
	WCDMA II (1900): 289
	WCDMA I (2100): 277
Channel spacing	200 kHz (WCDMA II 100/200 kHz)
Number of Tx power levels	GSM850: 15
	GSM900: 15
	GSM1800: 16
	GSM1900: 16
	WCDMA VIII (900): 75
	WCDMA II (1900): 75
	WCDMA I (2100): 75

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Main RF characteristics for GSM850/900/1800/1900 and WCDMA V/II/I phones

Parameter	Unit
Cellular system	GSM850, EGSM900, GSM1800/1900, WCDMA V (850), WCDMA II (1900) and WCDMA I (2100)
Rx frequency band	GSM850: 869 - 894MHz
	EGSM900: 925 - 960 MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz
	WCDMA V (850): 869 - 894 MHz
	WCDMA II (1900): 1930 - 1990 MHz
	WCDMA I (2100): 2110 - 2170 MHz
Tx frequency band	GSM850: 824 - 849MHz
	EGSM900: 880 - 915 MHz
	GSM1800: 1710 - 1785 MHz
	GSM1900: 1850 - 1910 MHz
	WCDMA V (850): 824 - 849 MHz
	WCDMA II (1900): 1850 - 1910 MHz
	WCDMA I (2100): 1920 - 1980 MHz
Output power	GSM850: +5 ...+33dBm/3.2mW ... 2W
	GSM900: +5 ... +33dBm/3.2mW ... 2W
	GSM1800: +0 ... +30dBm/1.0mW ... 1W
	GSM1900: +0 ... +30dBm/1.0mW ... 1W
	WCDMA V (850): -50 ... +24 dBm/0.01µW ... 251.2mW
	WCDMA II (1900): -50 ... +24 dBm/0.01µW ... 251.2mW
	WCDMA I (2100): -50 ... +24 dBm/0.01µW ... 251.2mW
EDGE output power	EDGE850: +5 ... +29dBm/3.2mW ... 794mW
	EDGE900: +5 ... +29dBm/3.2mW ... 794mW
	EDGE1800: +0 ... +26dBm/1.0mW ... 400mW
	EDGE1900:+0 ... +26dBm/1.0mW ... 400mW

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Parameter	Unit
Number of RF channels	GSM850: 124
	GSM900: 174
	GSM1800: 374
	GSM1900: 299
	WCDMA V (850): 108
	WCDMA II (1900): 289
	WCDMA I (2100): 277
Channel spacing	200 kHz (WCDMA V and II 100/200 kHz)
Number of Tx power levels	GSM850: 15
	GSM900: 15
	GSM1800: 16
	GSM1900: 16
	WCDMA V (850): 75
	WCDMA II (1900): 75
	WCDMA I (2100): 75

Battery endurance

Battery	Capacity (mAh)	Talk time	Stand-by
BP-4L	1500	GSM: up to 400min	GSM: up to 430h
		WCDMA: up to 320min	WCDMA: up to 400h

Charging times

AC-10
4h

Environmental conditions

Environmental condition	Ambient temperature	Notes
Normal operation	-10 ºC ... +55 ºC	Specifications fulfilled
Reduced performance	55 ºC ... +70 ºC	Operational only for short periods
Intermittent or no operation	-40 ºC ... -15 ºC and +70 ºC ... +85ºC	Operation not guaranteed but an attempt to operate will not damage the phone
No operation or storage	<-40 ºC and >+85 ºC	No storage. An attempt to operate may cause permanent damage

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Environmental condition	Ambient temperature	Notes
Charging allowed	-15 ºC ... +55 ºC	
Long term storage conditions	0 ºC ... +85 ºC	
Humidity and water resistance		Relative humidity range is 5 to 95%. Condensed or dripping water may cause intermittent malfunctions. Protection against dripping water has to be implemented in (enclosure) mechanics. Continuous dampness will cause permanent damage to the module.

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2 — Service Tools and Service Concepts

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Service tools

Product specific tools

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-505; RM-506. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

<table>
<tr><td rowspan="2">
</td><td>FS-102</td><td>Flash adapter</td><td></td></tr>
<tr><td colspan="3">• FS-102 is equipped with a clip interlock system
• provides standardised interface towards Control Unit
• multiplexing between USB and FBUS media, controlled by VUSB</td></tr>
</table>

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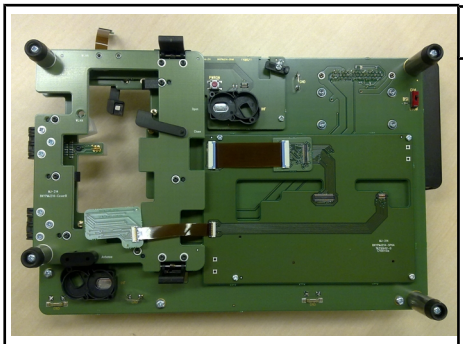

MJ-214	Module jig	

MJ-214 is meant for component level troubleshooting.

The jig includes RF interface for Bluetooth, WLAN and GPS. In addition, it has the following features:

- Provides mechanical interface with the engine module
- Provides galvanic connection to all needed test pads in module
- Multiplexing between USB and FBUS media, controlled by Vusb
- Connector for control unit
- Access for Audio-, MMC, and USB connectors
- **Module jig attenuation values:**

Band	F	Attenuation
GSM850 TX	824-849	0.4dB
GSM850 RX	869-894	0.4dB
EGSM900 TX	880-915	0.4dB
EGSM900 RX	935-960	0.4dB
GSM1800 TX	1710-1785	0.6dB
GSM1800 RX	1805-1880	0.6dB
GSM1900 TX	1850-1910	0.6dB
GSM1900 RX	1930-1990	0.6dB
WLAN TX		0.6dB@2442MHz
FMTx		25.27dB@107.9dBm with 22nH
WCDMA850 TX	824-849	0.4dB
WCDMA850 RX	869-894	0.4dB
WCDMA1900 TX	1850-1910	0.6dB
WCDMA1900 RX	1930-1990	0.6dB

RJ-230	Soldering jig	

The jig is used for soldering and as a rework jig for the system module. It is made of lead-free rework compatible material.

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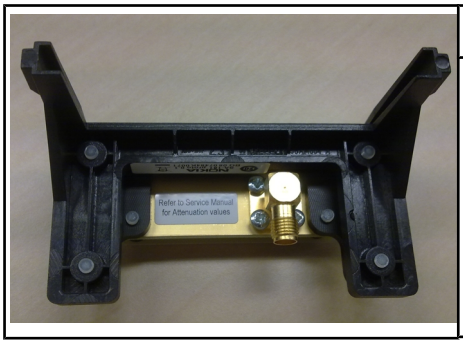
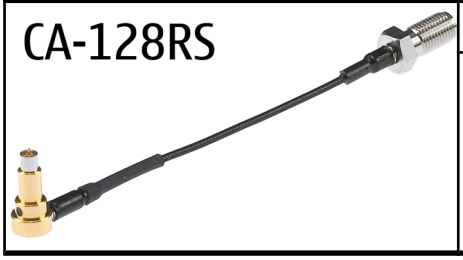
	SA-181	RF coupler	
	SA-181 is an RF coupler for WCDMA and GSM RF testing. It is used together with the product-specific flash adapter.		

Cables

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-505; RM-506. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

	CA-101	Micro USB cable	
	The CA-101 is a USB-to-microUSB data cable that allows connections between the PC and the phone.		
	CA-128RS	RF tuning cable	
	Product-specific adapter cable for RF tuning.		

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CA-31D	USB cable	
The CA-31D USB cable is used to connect FPS-21 to a PC. It is included in the FPS-21 sales package.		

CA-35S	Power cable	
CA-35S is a power cable for connecting, for example, the FPS-21 flash prommer to the Point-Of-Sales (POS) flash adapter.		

PCS-1	Power cable	
The PCS-1 power cable (DC) is used with a docking station, a module jig or a control unit to supply a controlled voltage.		

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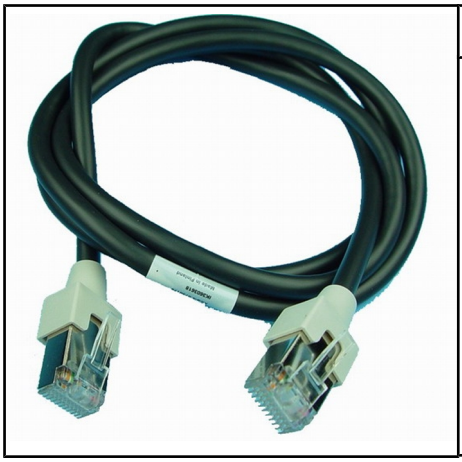	XCS-4	Modular cable	
	XCS-4 is a shielded (one specially shielded conductor) modular cable for flashing and service purposes.		

Service concepts

POS (Point of Sale) flash concept

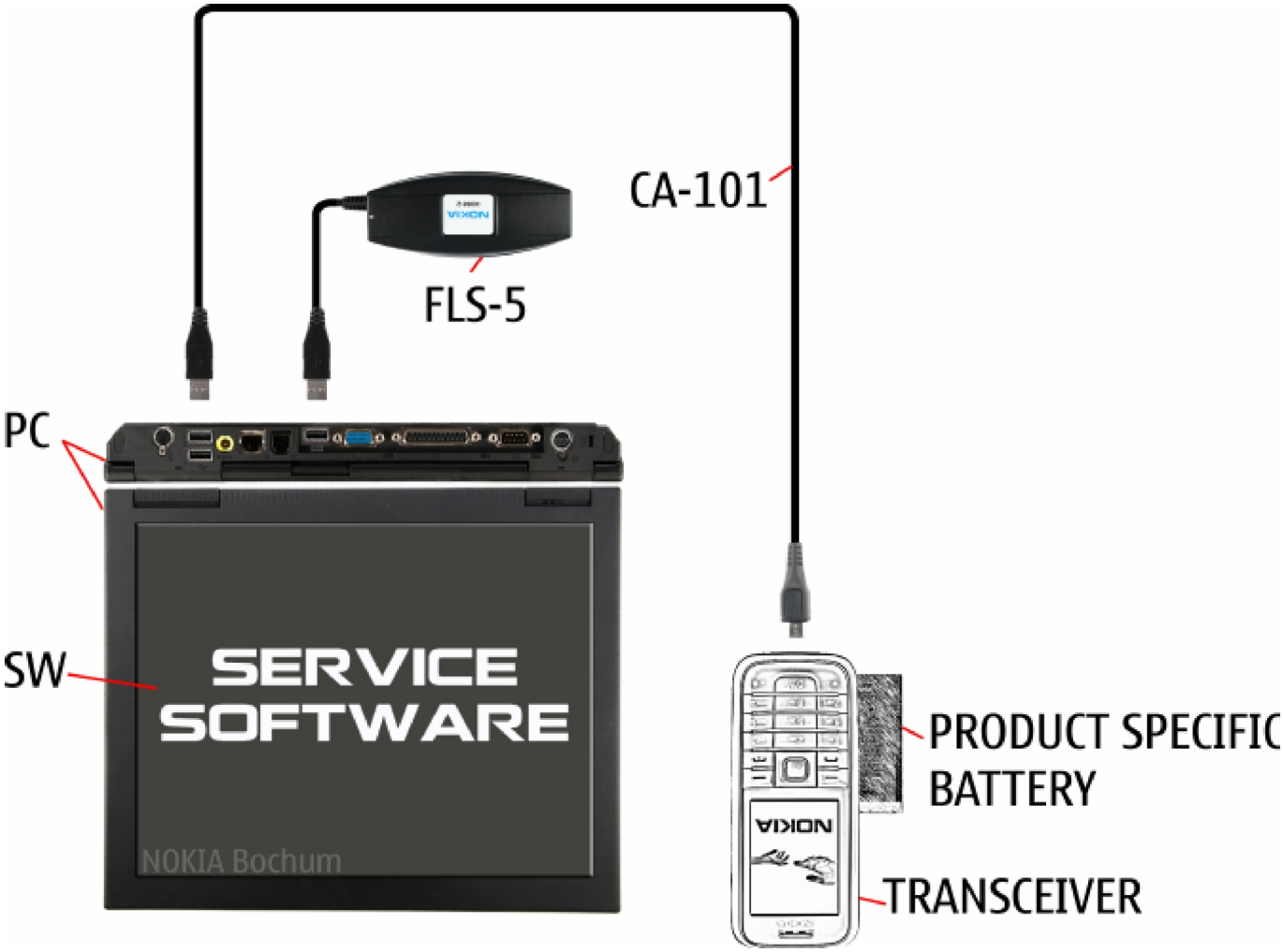

Figure 2 POS flash concept

Type	Description
Product specific tools	

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Type	Description
BP-4L	Battery
Other tools	
FLS-5	POS flash dongle
	PC with Phoenix service software
Cables	
CA-101	USB connectivity cable

Flash concept with FPS-21

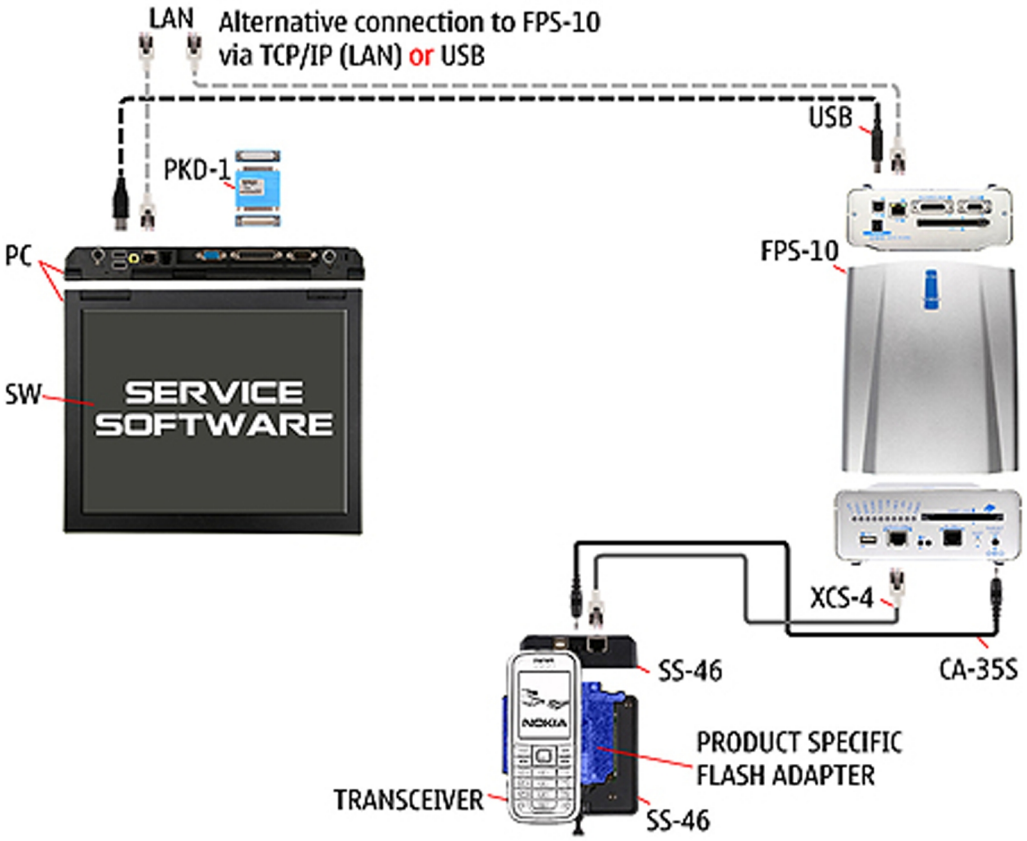

Figure 3 Basic flash concept with FPS-21

Type	Description
Product specific devices	
FS-102	Flash adapter
Other devices	
FPS-21	Flash prommer box
PKD-1/PK-1	SW security device
SS-46	Interface adapter
	PC with Phoenix service software
Cables	

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Type	Description
XCS-4	Modular cable
CA-35S	Power cable
	USB cable

CU-4 flash concept with FPS-21

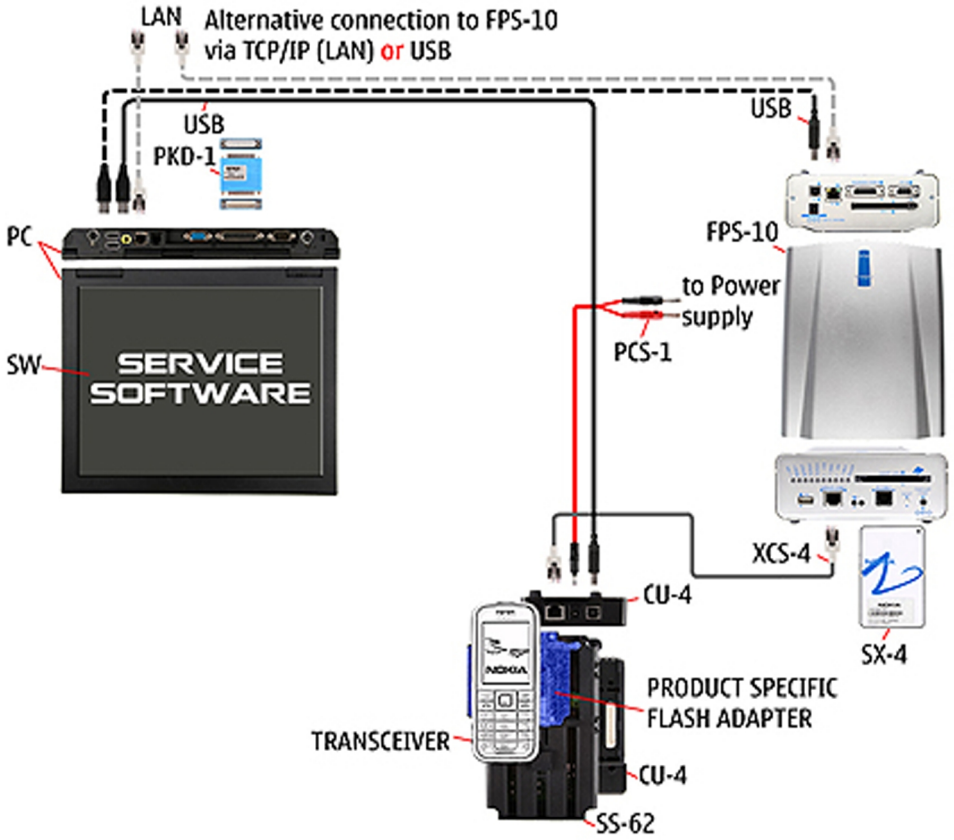

Figure 4 CU-4 flash concept with FPS-21

Type	Description
Product specific devices	
FS-102	Flash adapter
Other devices	
CU-4	Control unit
FPS-21	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
SX-4	Smart card
	PC with Phoenix service software
Cables	
PCS-1	Power cable

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Type	Description
XCS-4	Modular cable
	Standard USB cable
	USB cable

Flash concept with FPS-21 and SB-6

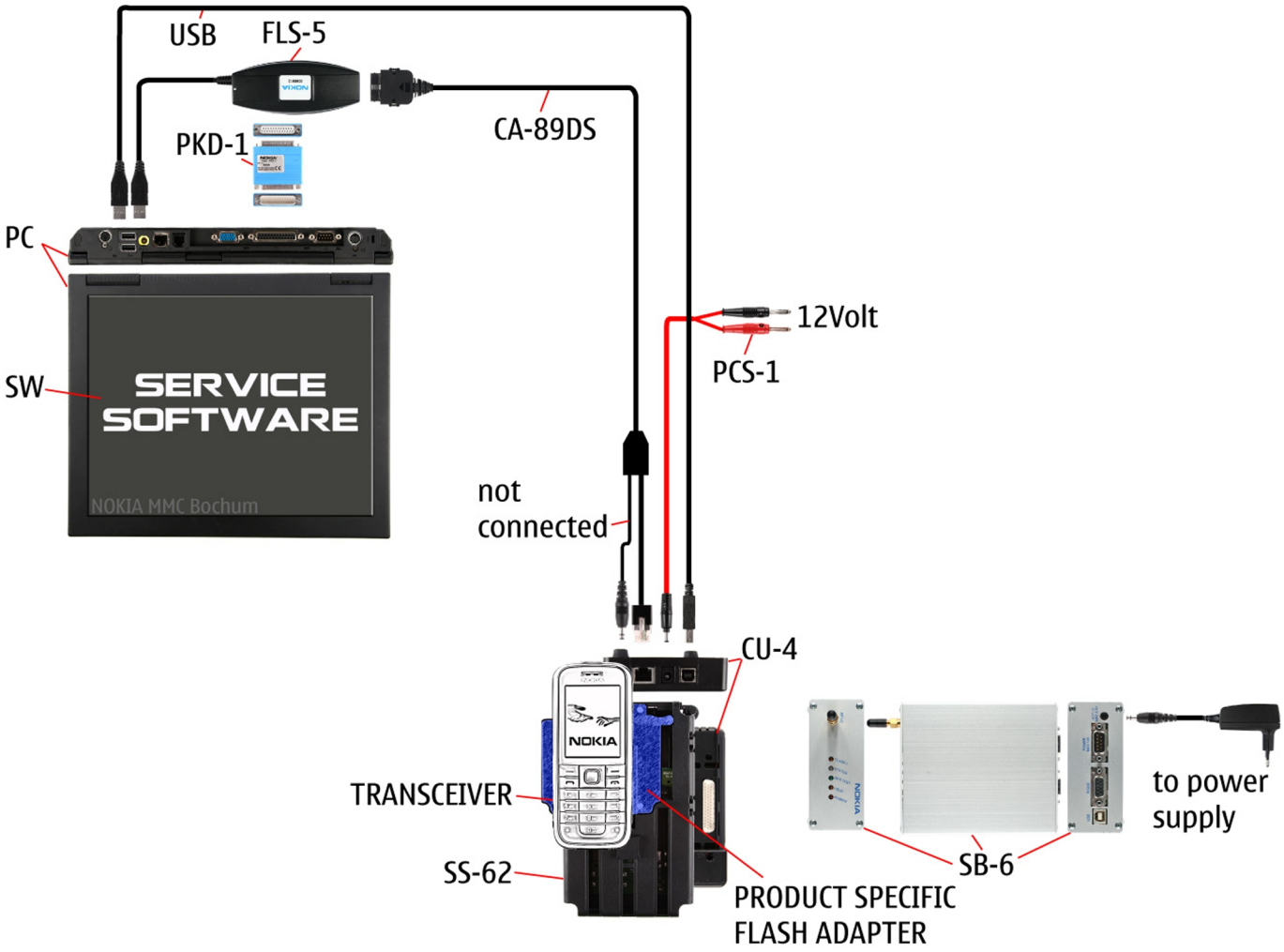

Figure 5 Flash concept with FPS-21 and SB-6

Type	Description
Product specific tools	
FS-102	Flash adapter
Other tools	
FPS-21	Flash prommer box
PKD-1/PK-1	SW security device
SS-46	Interface adapter
SB-6	Bluetooth test and interface box

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Type	Description
	PC with Phoenix service software
Cables	
XCS-4	Modular cable
CA-35S	Power cable
	USB cable

Flash concept with SS-46 and CA-89DS

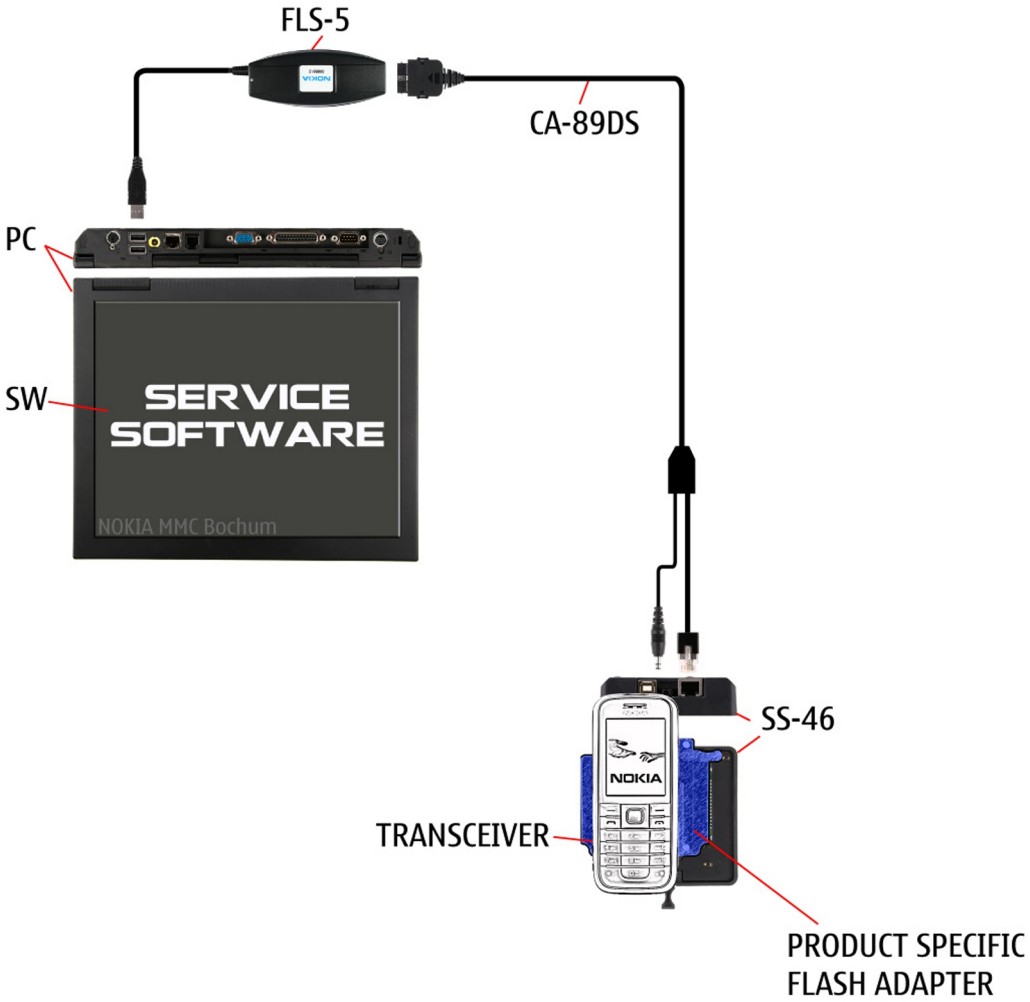

Figure 6 Flash concept with SS-46 and CA-89DS

Type	Description
Product specific tools	
FS-102	Flash adapter
Other tools	
FLS-5	Flash device
SS-46	Interface adapter

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Type	Description
	PC with Phoenix service software
Cables	
CA-89DS	Cable

Flash concept with SS-62 and CA-89DS

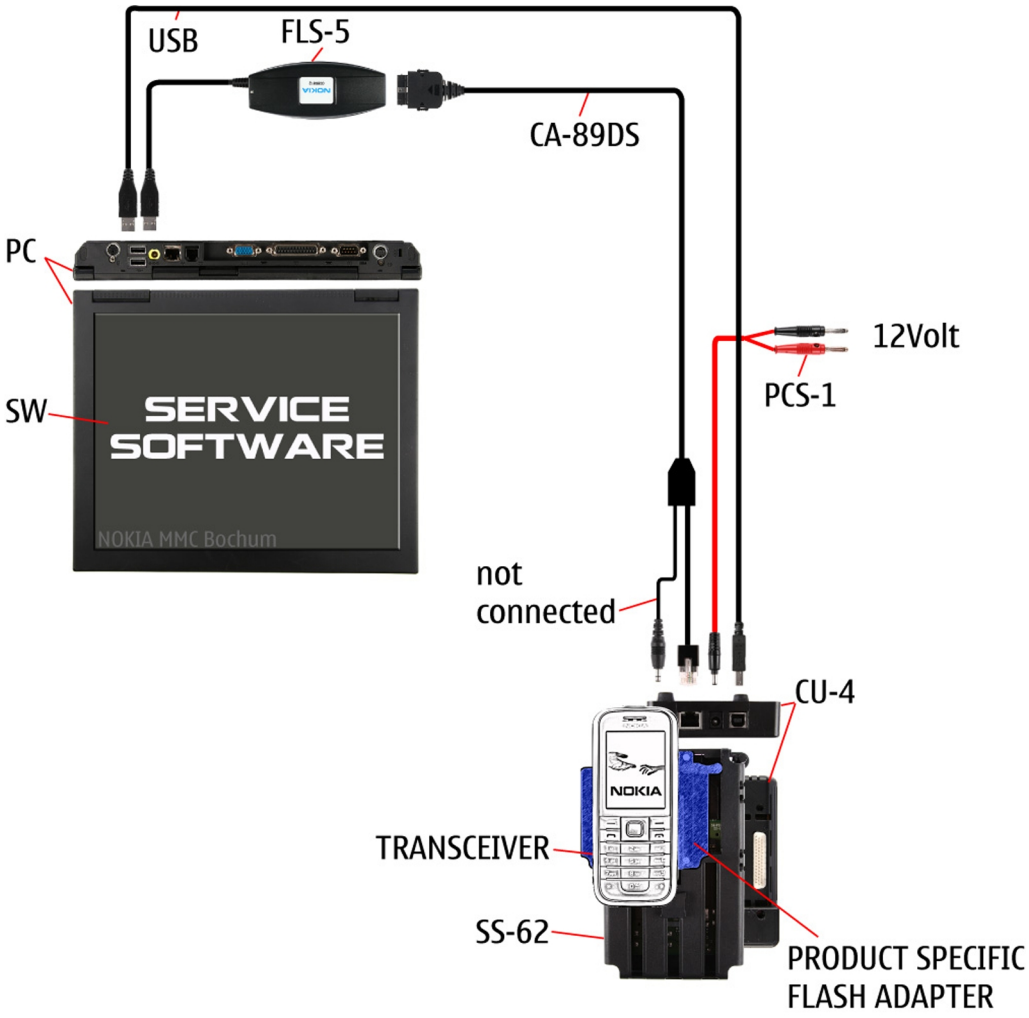

Figure 7 Flash concept with SS-62 and CA-89DS

Type	Description
Product specific tools	
FS-102	Flash adapter
Other tools	
CU-4	Control unit
FLS-5	Flash device
SS-62	Flash adapter base
	PC with Phoenix service software

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Type	Description
Cables	
CA-89DS	Cable
PCS-1	Power cable
	USB cable

Flash concept with FPS-21, SS-62 and SB-6

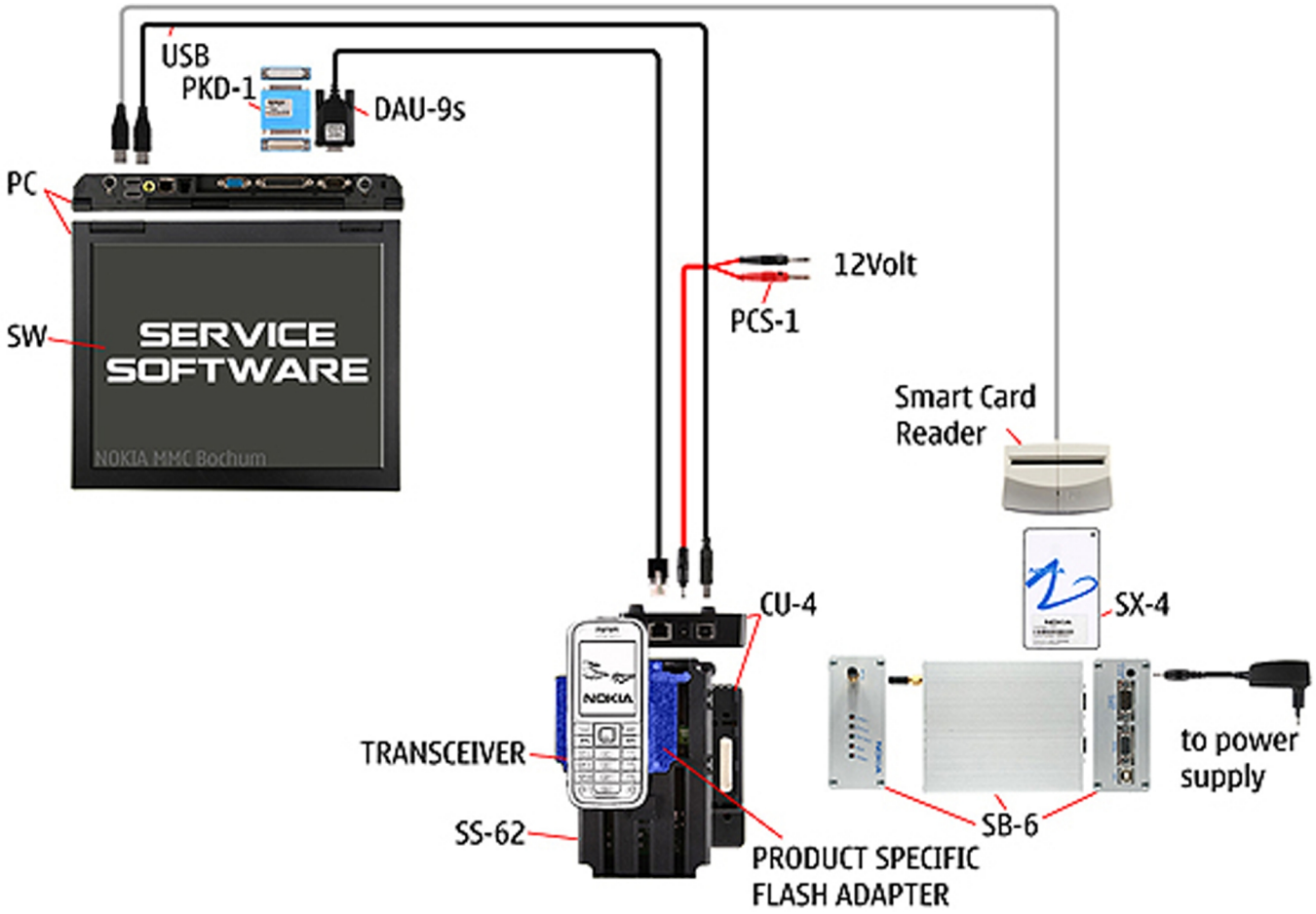

Figure 8 Flash concept with FPS-21, SS-62 and SB-6

Type	Description
Product specific tools	
FS-102	Flash adapter
Other tools	
CU-4	Control unit
FPS-21	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
SB-6	Bluetooth test and interface box

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Type	Description
SX-4	Smart card
	PC with Phoenix service software
Cables	
XCS-4	Modular cable
PCS-1	Power cable
	USB cable

Flash concept with FPS-21, SS-62 and SB-7

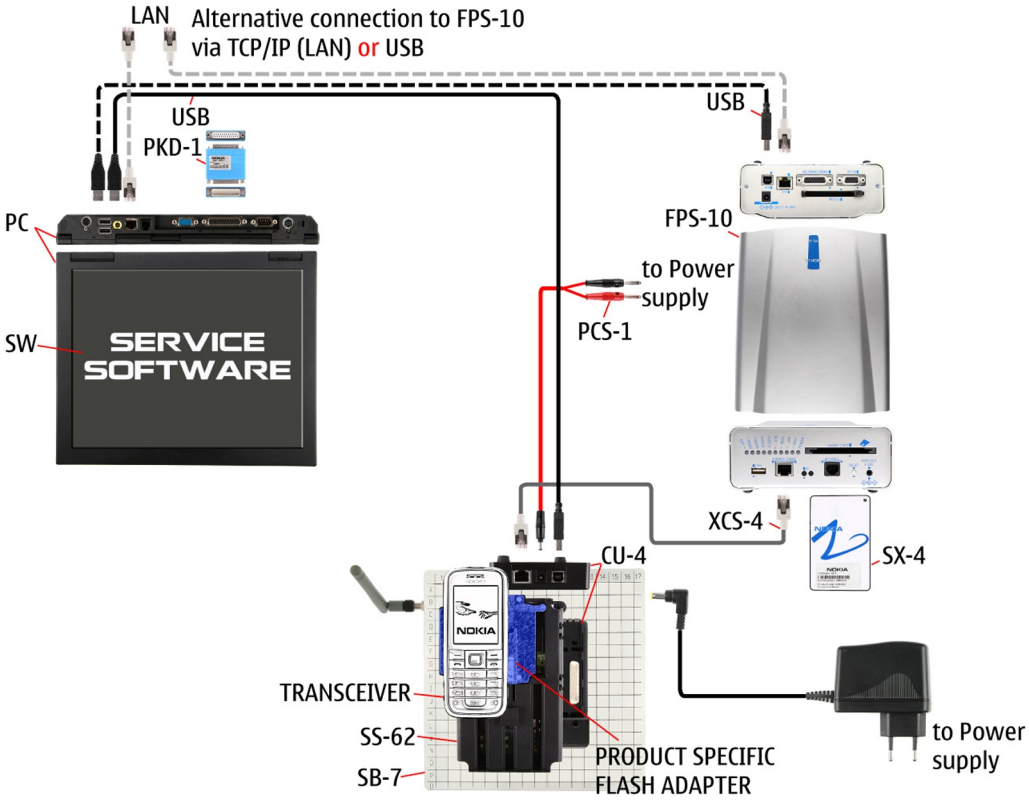

Figure 9 Flash concept with FPS-21, SB-7 and JBT-9

Type	Description
Product specific tools	
FS-102	Flash adapter
Other tools	
CU-4	Control unit
FPS-21	Flash prommer box
PKD-1/PK-1	SW security device
SB-7	WLAN test box
SS-62	Flash adapter base

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Type	Description
SX-4	Smart card
	PC with Phoenix service software
Cables	
XCS-4	Modular cable
PCS-1	Power cable
	USB cable

Module jig service concept

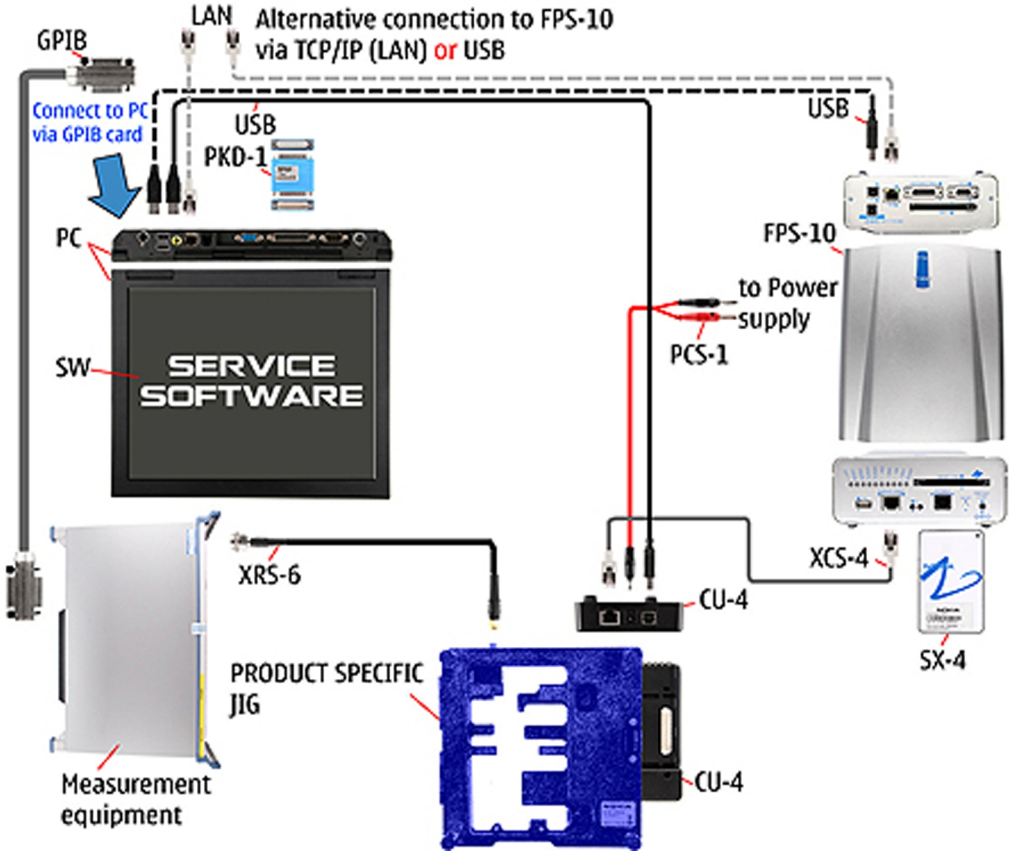

Figure 10 Module jig service concept

Type	Description
Phone specific devices	
MJ-214	Module jig
Other devices	
CU-4	Control unit
FPS-21	Flash prommer box
PK-1	SW security device
SX-4	Smart card

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Type	Description
	PC with VPOS and Phoenix service software
	Measurement equipment
Cables	
PCS-1	DC power cable
XCS-4	Modular cable
XRS-6	RF cable
CA-128RS	RF tuning cable
	USB cable
	GPIB control cable

Module jig service concept with SB-6

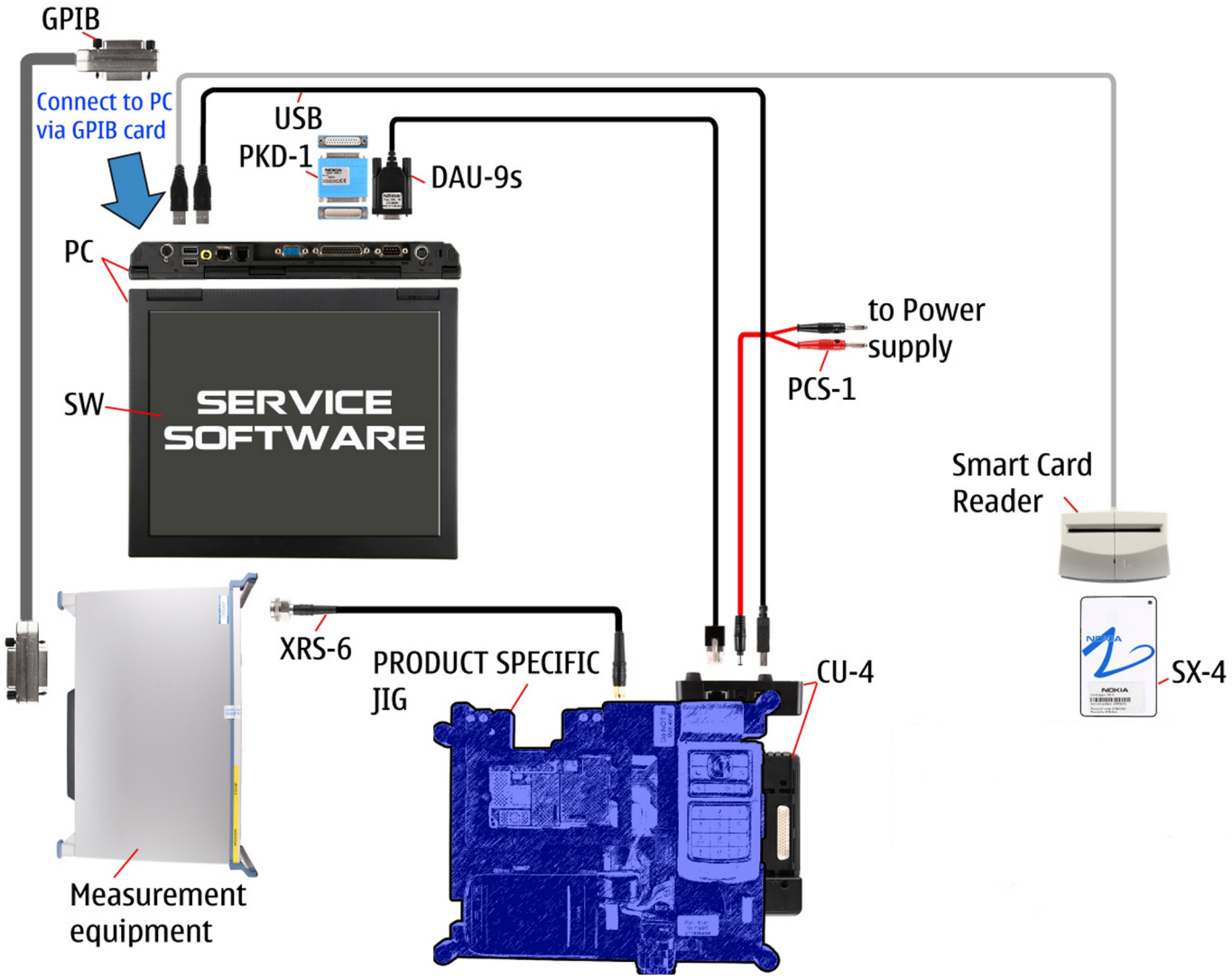

Figure 11 Module jig service concept with SB-6

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Type	Description
Product specific tools	
MJ-214	Module jig
Other tools	
CU-4	Control unit
FPS-21	Flash prommer box
SB-6	Bluetooth test and interface box
PKD-1	SW security device
SX-4	Smart card
	Measurement equipment
	PC with Phoenix service software
Cables	
PCS-1	DC power cable
XCS-4	Modular cable
XRS-6	RF cable
CA-128RS	RF tuning cable
	GPIB control cable
	USB cable

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RF testing concept with RF coupler

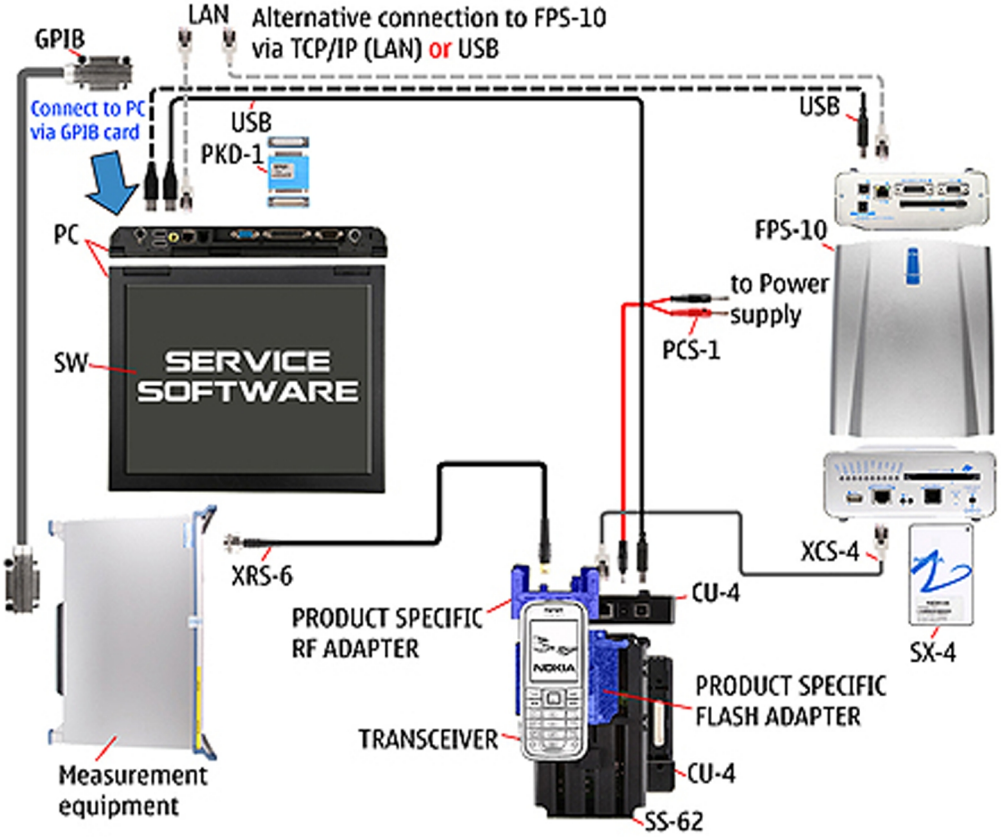

Figure 12 RF testing concept with RF coupler

Type	Description
Product specific devices	
FS-102	Flash adapter
SA-181	RF coupler
Other devices	
CU-4	Control unit
SX-4	Smart card
FPS-21	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
	Measurement equipment
	PC with Phoenix service software
Cables	
PCS-1	Power cable
XCS-4	Modular cable
XRS-6	RF cable

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Type	Description
	GPIB control cable
	USB cable

Service concept for RF testing and RF/BB tuning

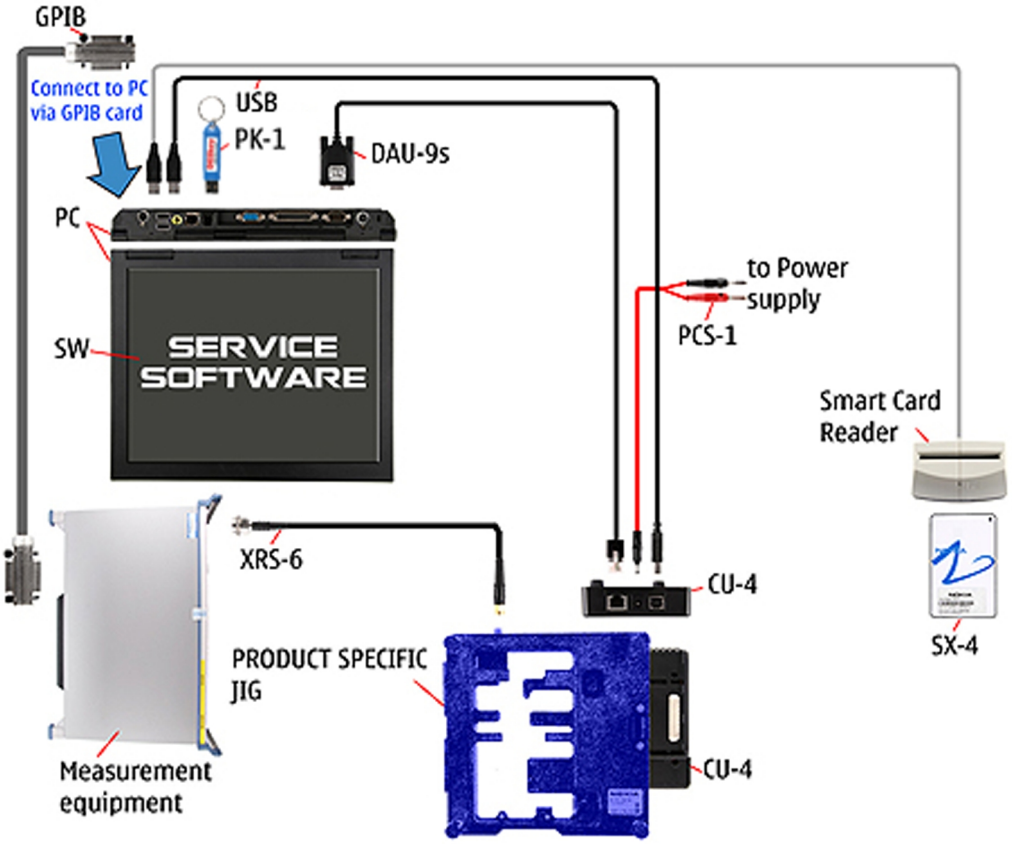

Figure 13 Service concept for RF testing and RF/BB tuning

Type	Description
Product specific devices	
MJ-214	Module jig
Other devices	
CU-4	Control unit
PK-1/PKD-1	SW security device
SX-4	Smart card
	Measurement equipment
	Smart card reader
	PC with Phoenix service software
Cables	
DAU-9S	MBUS cable

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Type	Description
PCS-1	DC power cable
XRS-6	RF cable
CA-128RS	RF tuning cable
	GPIB control cable
	USB cable

Module jig MJ-214 set-up instruction

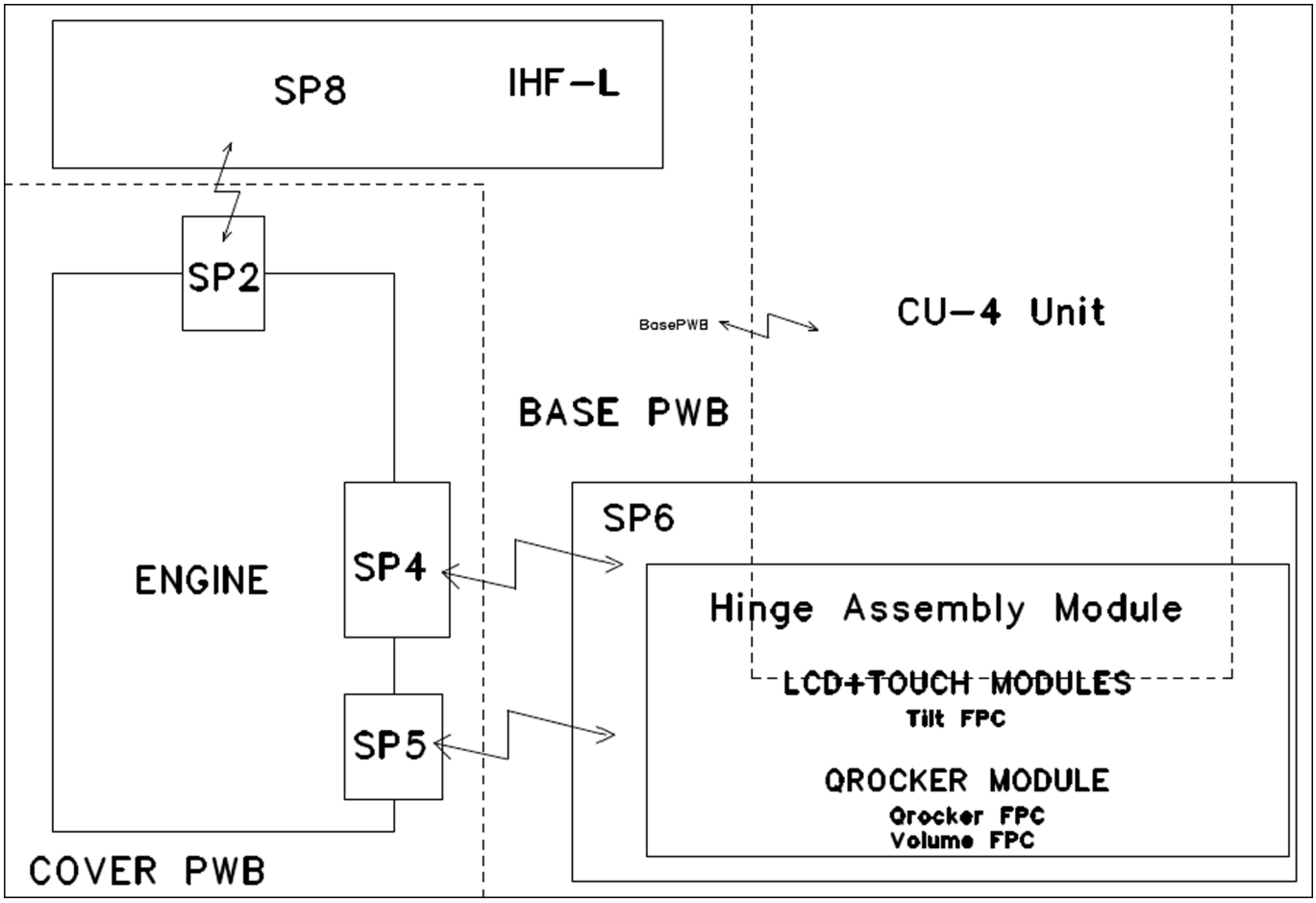

Figure 14 Module jig block diagram

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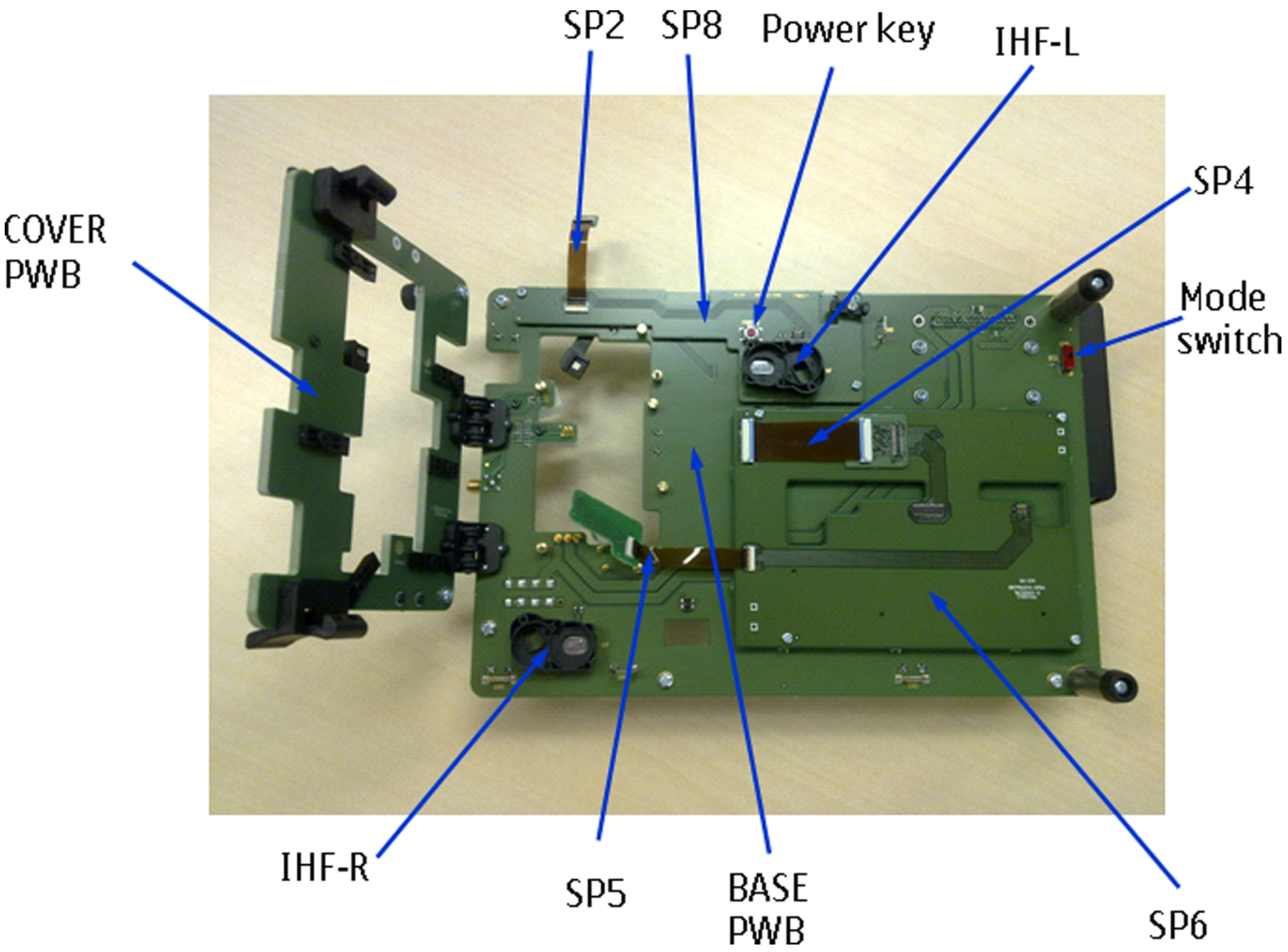

Figure 15 Module jig top view (without module setup)

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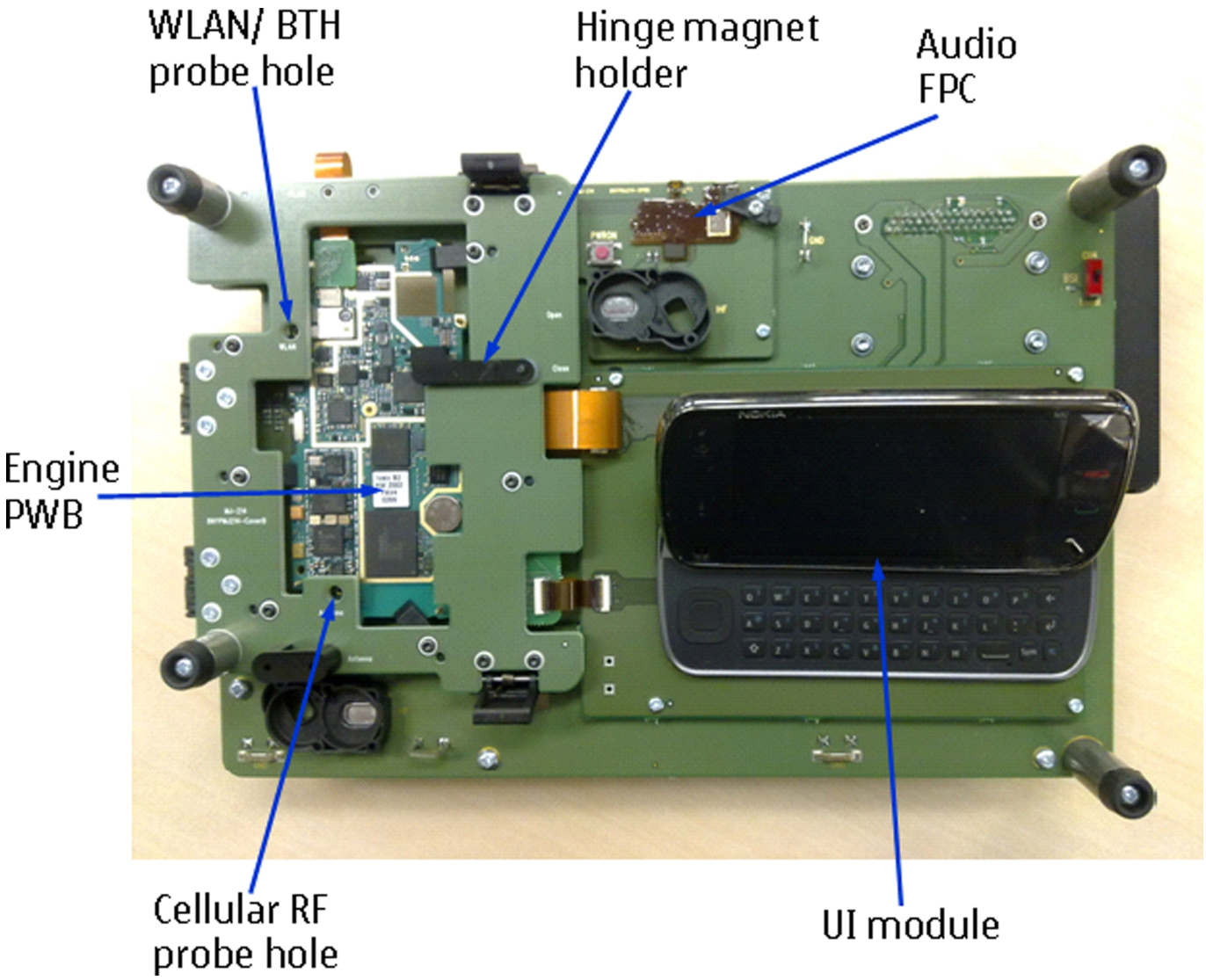

Figure 16 Module jig top view (with module setup)

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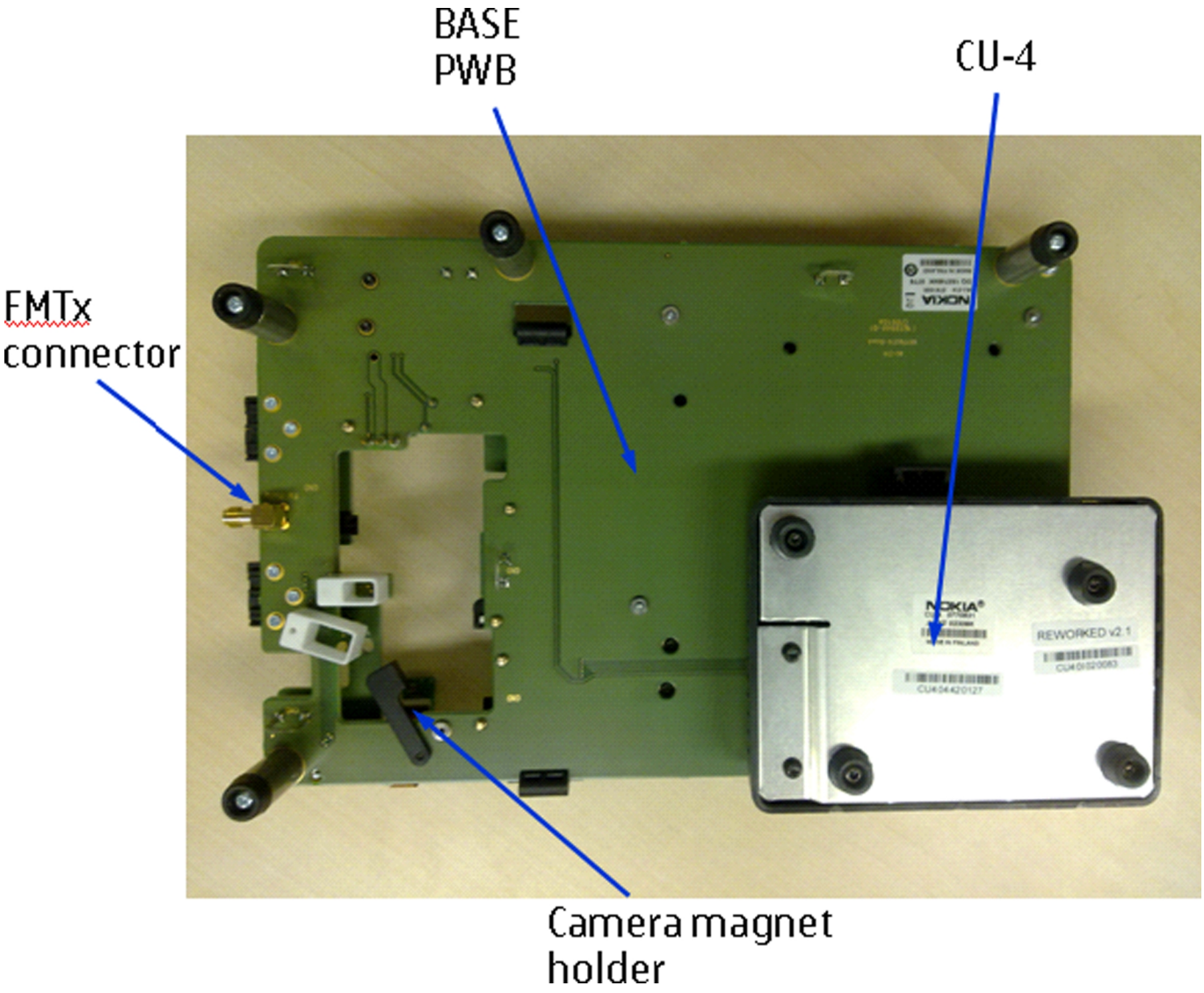

Figure 17 Module jig bottom view

Some clarifications for the above views:

- Power key: simulate phone power key
- IHF: simulate phone IHF
- Mode switch: select CU-4, BSI or Local mode
- Hinge magnet holder: simulate hinge open/close
- Camera magnet holder: simulate camera lens cover open/close
- UI module: Phone UI part
- Audio FPC: Phone Audio FPC
- SP2, SP4 and SP5: available as MJ-214 spare part

  Note: Important notes:

  - Select a working phone UI part to fix in the module jig. Do not take it off unless needed. Use it for reference for engine repair.
  - SP6 can be disassembled in order to fix UI module to it easily.
  - Use 3 phone screws to fix UI module to the module jig.

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- Treat all connectors carefully as they are sensitive to be damaged.
- Use phone SIM holder soldered on engine board to test SIM card.
- Use phone SD card holder on Bezel FPC connected to engine board to test SD card.

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3 — BB Troubleshooting and Manual Tuning Guide

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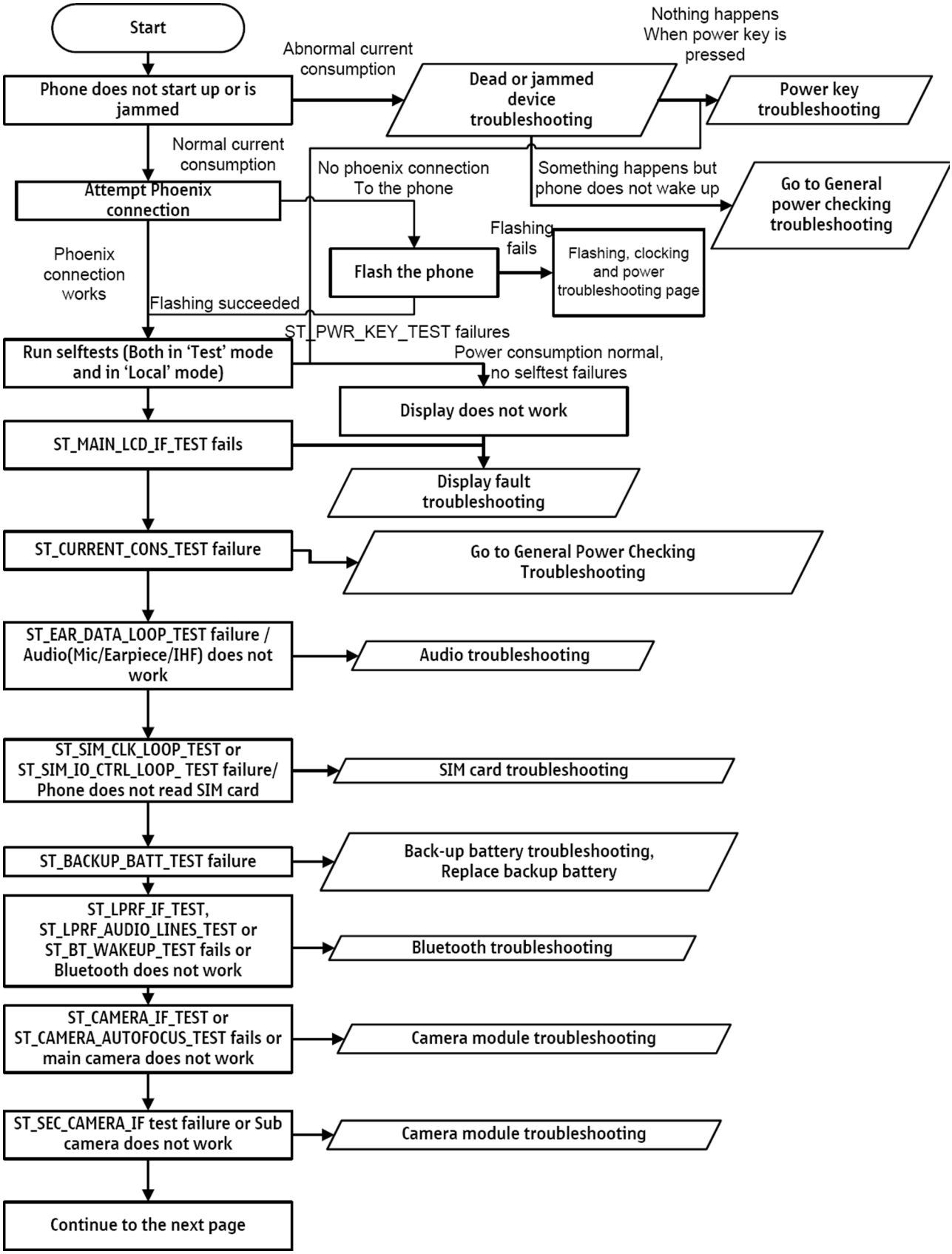
Baseband main troubleshooting

Troubleshooting flow



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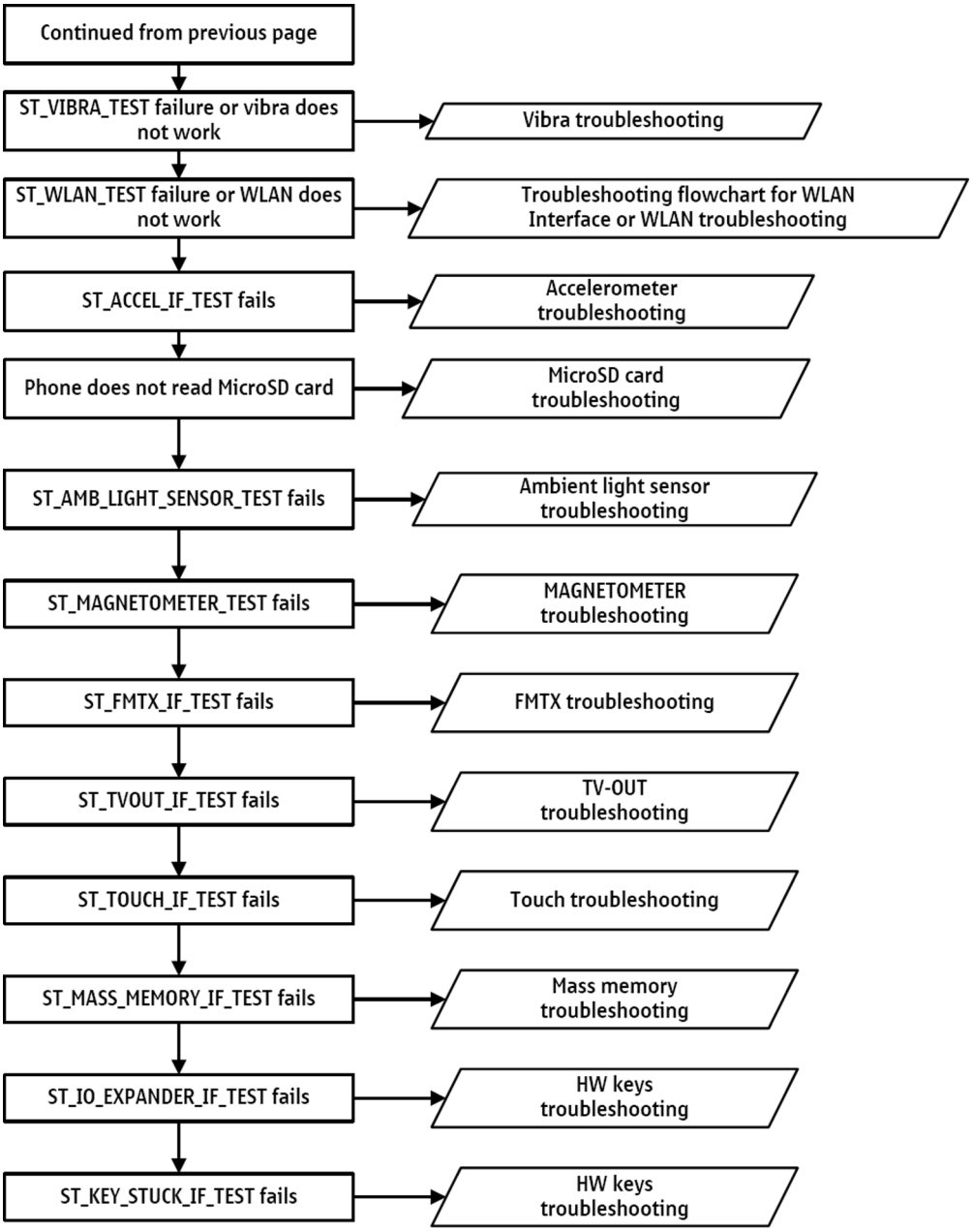

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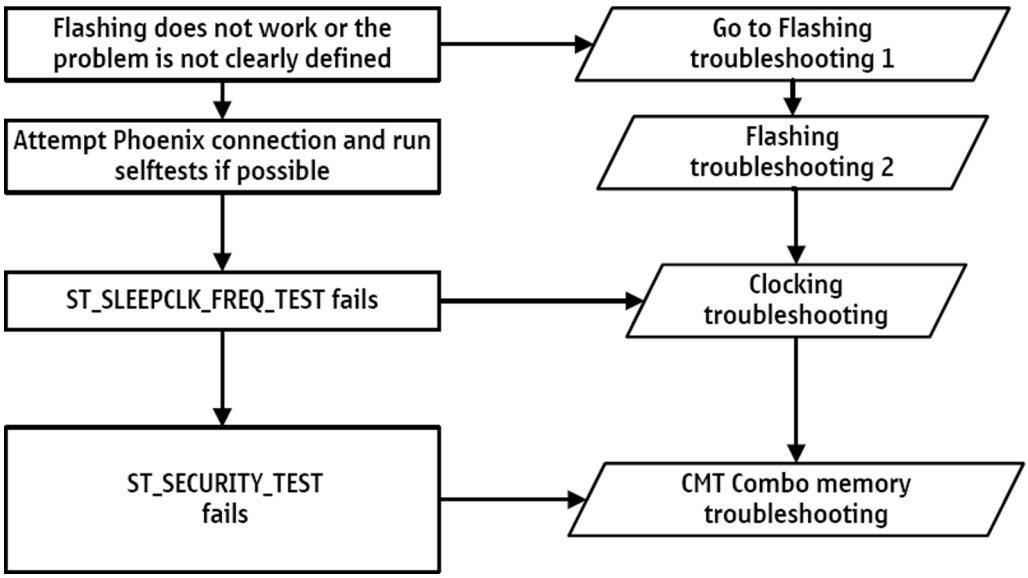
Flashing, clocking and power troubleshooting



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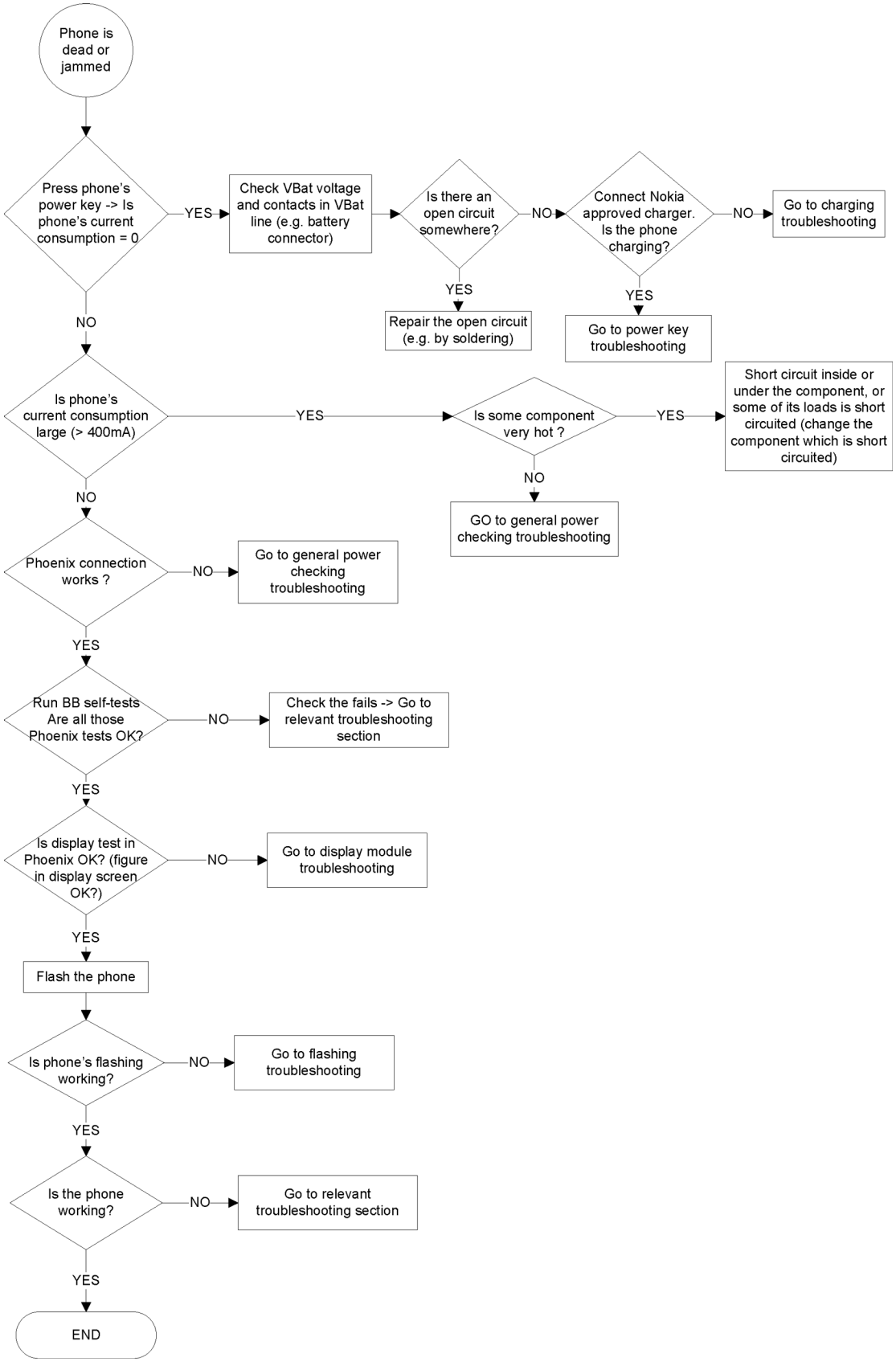
Dead or jammed device troubleshooting

Troubleshooting flow



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General power checking

General power checking

Signal name	Regulator	Sleep	Idle	Nominal voltage	Main user	Notes	Supply
VIO_V	AVILMA	ON	ON	1.82	Vilma I/O		VBAT1
VBACK	AVILMA	ON	ON	2.5	RTC circuitry		
VSIM1	AVILMA	ON	ON	1.8/3.0	SIM card		VBAT3
VSIM2	AVILMA	ON	ON	1.0	Digital microphone		VBAT3
VAUX	AVILMA	ON	ON	2.78	Accelerometer, proximity sensor, TV out driver, display		VBAT5
VANA	AVILMA	ON	ON	2.5	Vilma internal		VBAT4
VR1	AVILMA	OFF	ON	2.5	VCTCXO		VBAT4
VRFC	AVILMA	OFF	OFF	1.8	RAPIDO converter		
VRCP1	AVILMA	OFF	OFF	4.75	RF module	RF active	VBATCP
VOUT	BETTY	ON	ON	2.5	Audio switch		VBAT
VAUD	BH30SA2	ON	ON	3.0	DAC33, FM Tx		VBAT
VCAM_1V8	TPS62600	OFF	OFF	1.8	Camera HWA , LP5952, cameras, flashlight driver		VBAT
VCAM_1V3	LP5952	OFF	OFF	1.3	Camera HWA core		LM3677
VCAM_2V8	BH28SA2	OFF	OFF	2.8	Cameras		VBAT
VCORE	TPS62350	ON	ON	1.2	Rapido core		VBAT
VIO	TPS62600	ON	ON	1.8	VIO, VDRAM		VBAT
VSD	SD levelsifter	OFF	OFF	2.9	SD card	ON when used	VBAT
LEDOUT	TK65604	OFF			Display backlights		VBAT
LED B,G,R	NJOY	OFF			QWERTY key LED, USB charging indicator		VBAT

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Signal name	Regulator	Sleep	Idle	Nominal voltage	Main user	Notes	Supply
LED B,G	NJOY_1	OFF			Menu key, Send/ End key, BEZEL LED		VBAT
	ADP1653	OFF	OFF	4.5/5.5	Camera flash, Video indicator		VBAT
VBAT				3.7			
VCORE_WD	LP5952	OFF	OFF	1.5	White Dwarf core		

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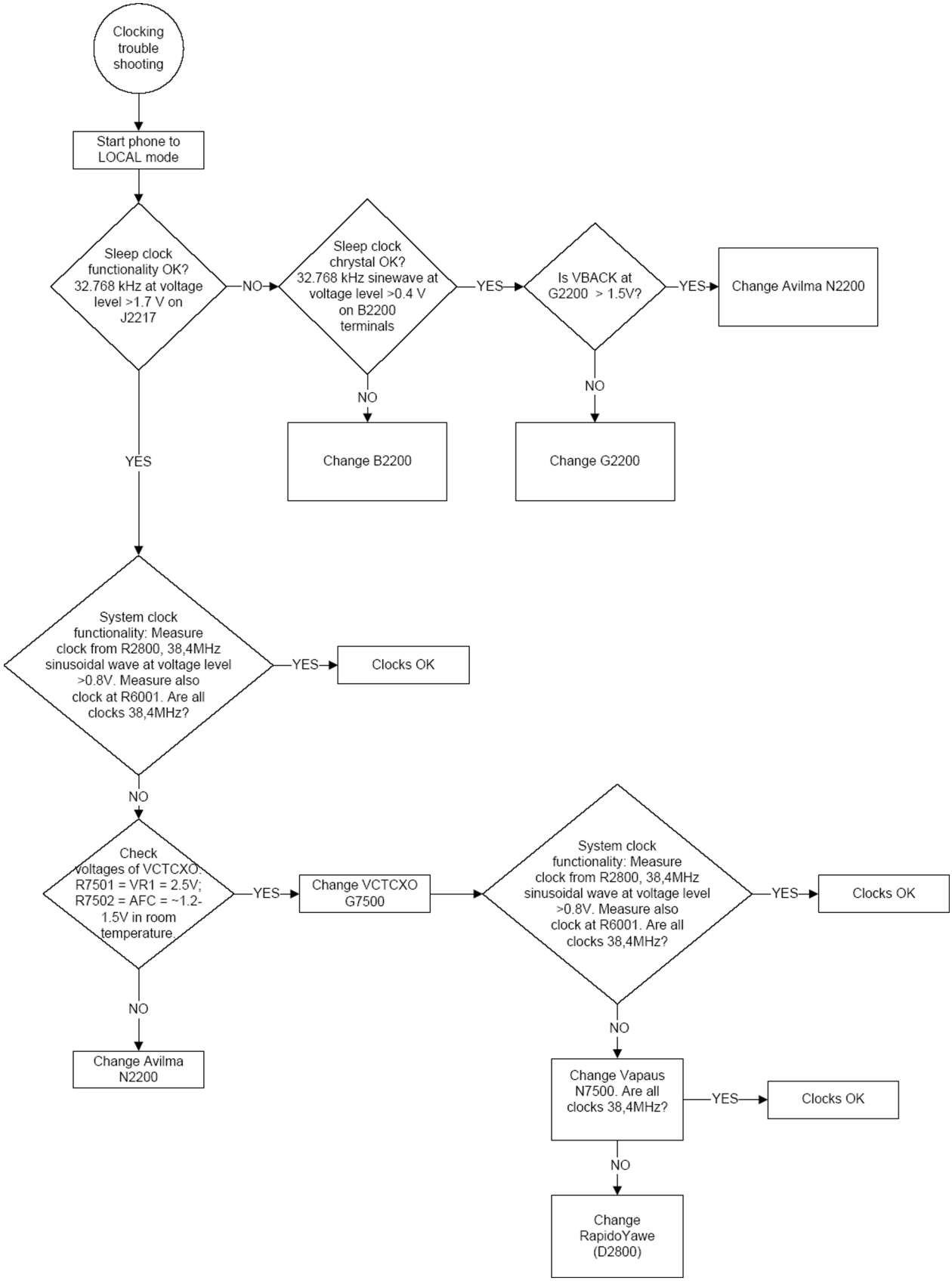
Clocking troubleshooting

Troubleshooting flow



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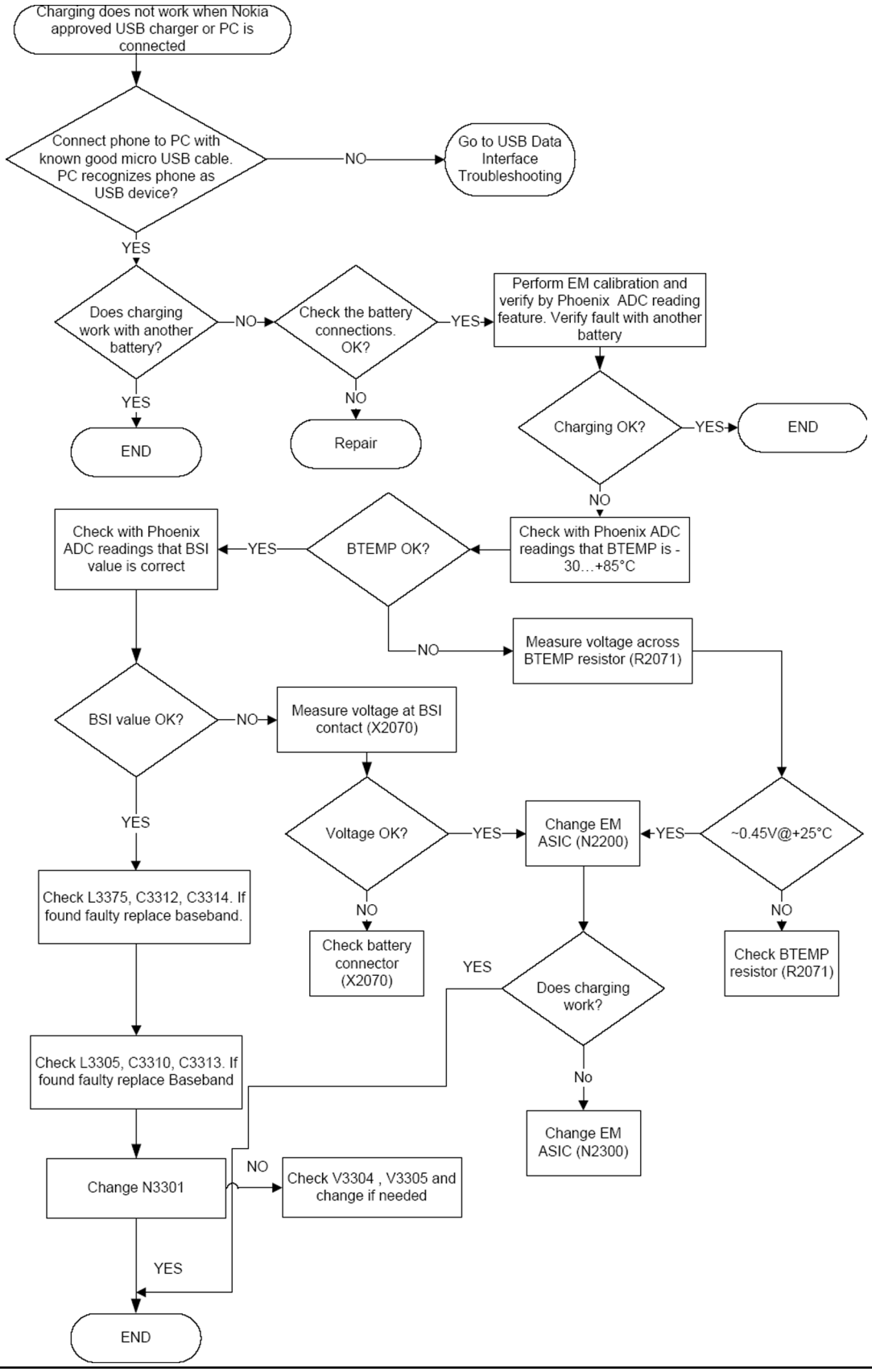
USB charging troubleshooting

Troubleshooting flow



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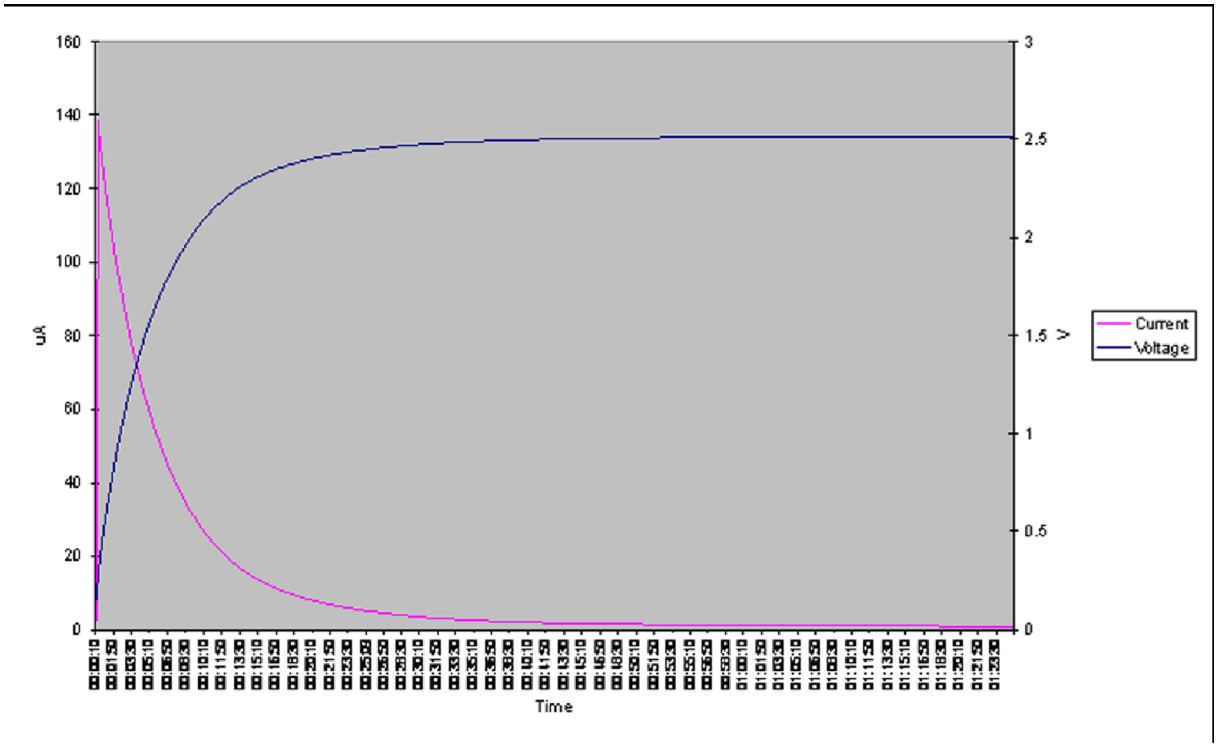
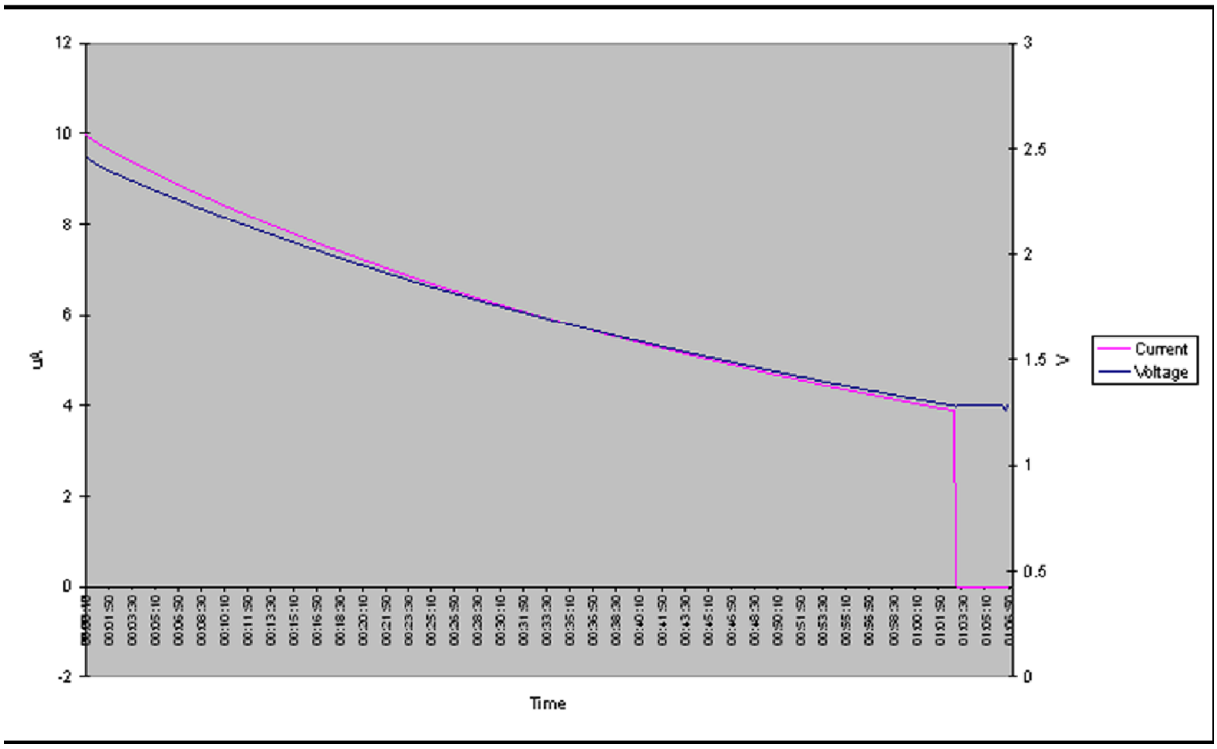
Backup battery troubleshooting

Verify that the backup battery G2200 is empty (U<1V). Switch the phone on. Measure voltage of the battery when the main battery is connected to the phone and the phone is switched on. Wait a few minutes and monitor that the backup battery voltage rises. Switch off the phone, disconnect the main battery and monitor that the voltage of the backup battery decreases. Normal behaviour of the voltage is described in the figures below:





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If the voltage rises and falls quickly, check the back-up battery G2200 contacts for loose soldering or short-circuit, and repair or change G2200 if necessary. If the voltage stays ~0V, check resistance VBACK against GND. If there is no shortcircuit, AVILMA N2200 is faulty. Replace N2200.

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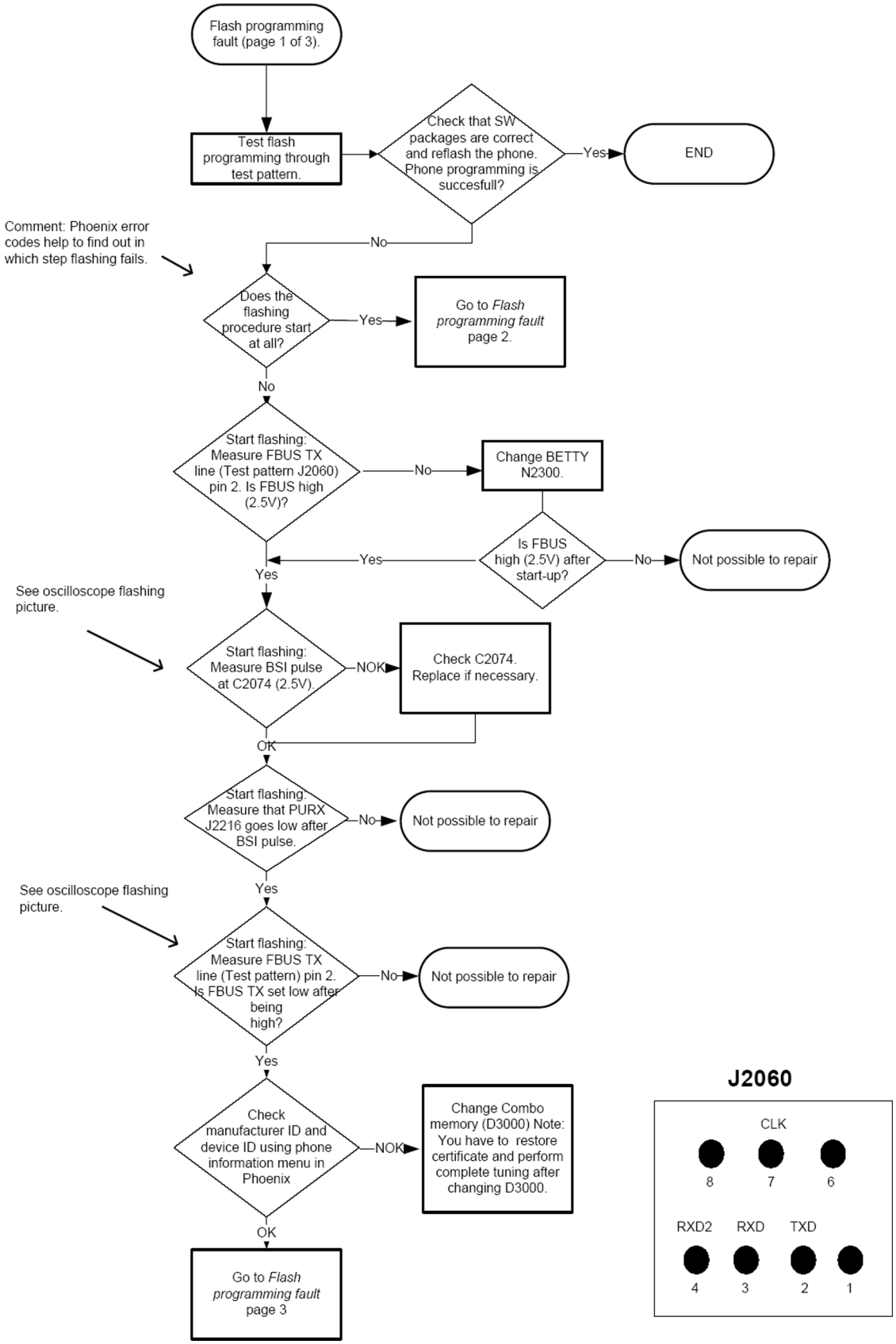
Flash programming troubleshooting

Troubleshooting flow



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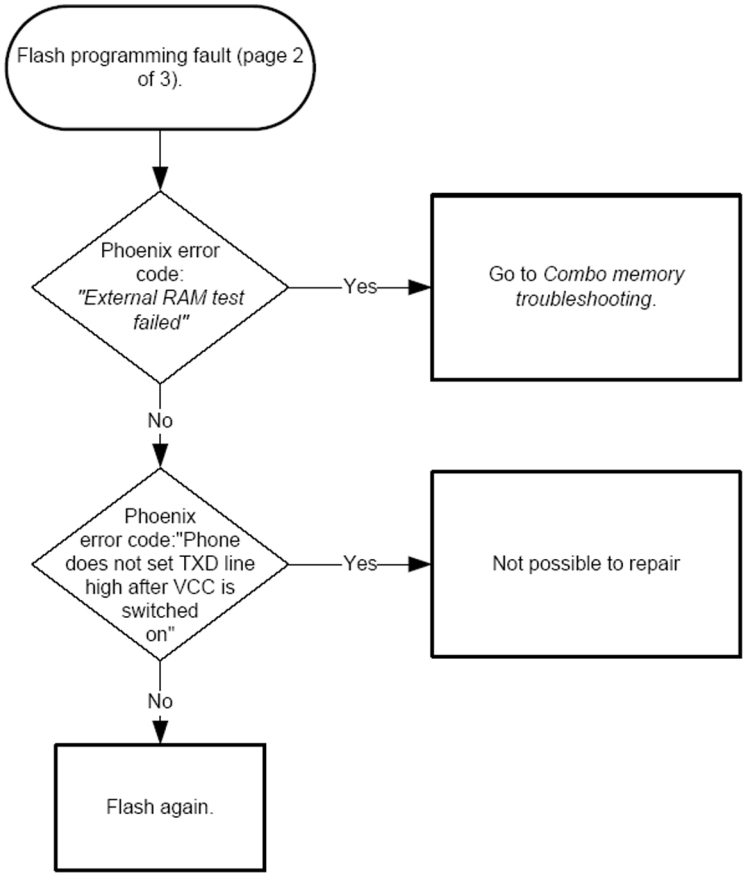

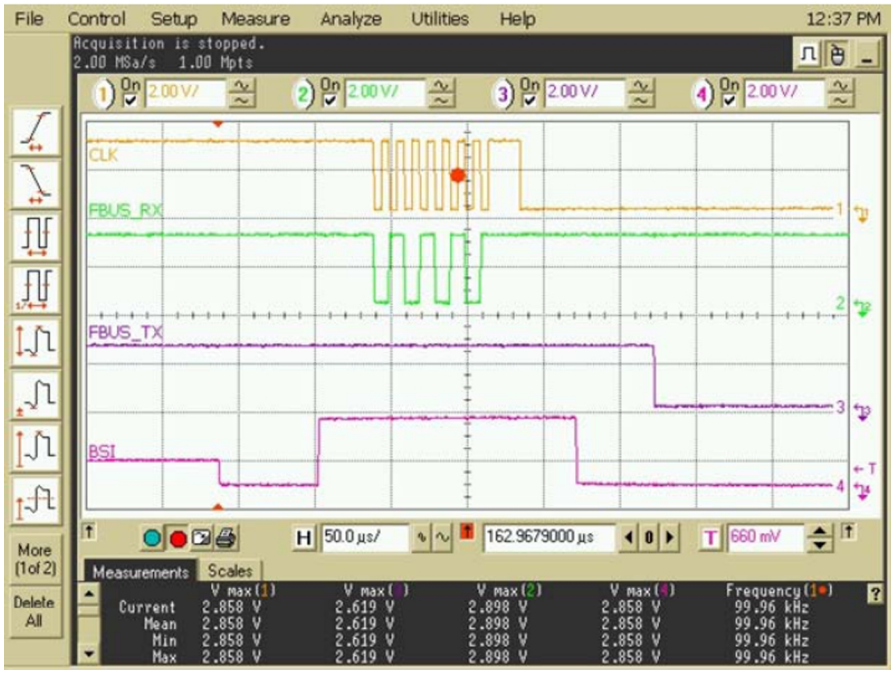

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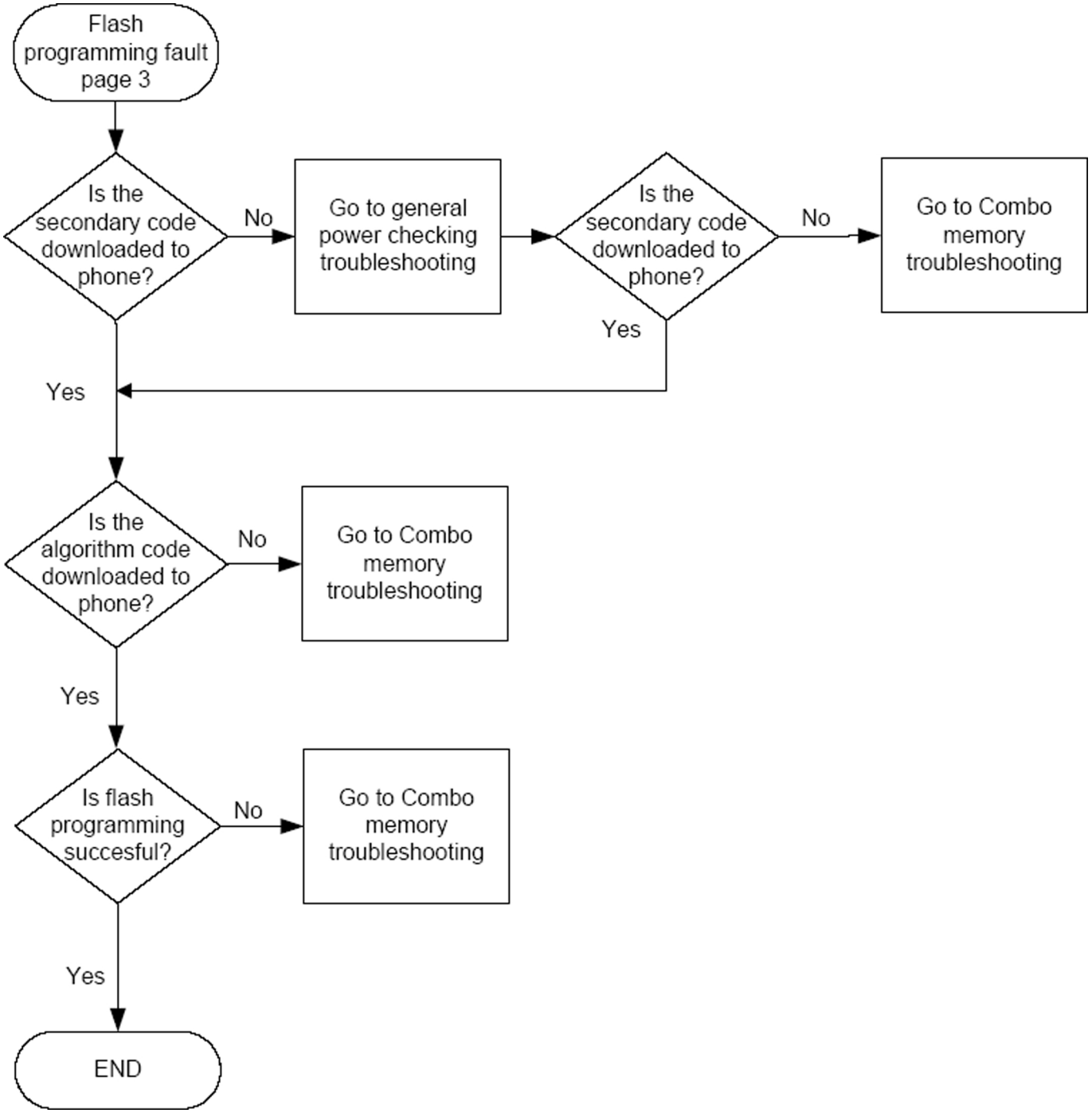

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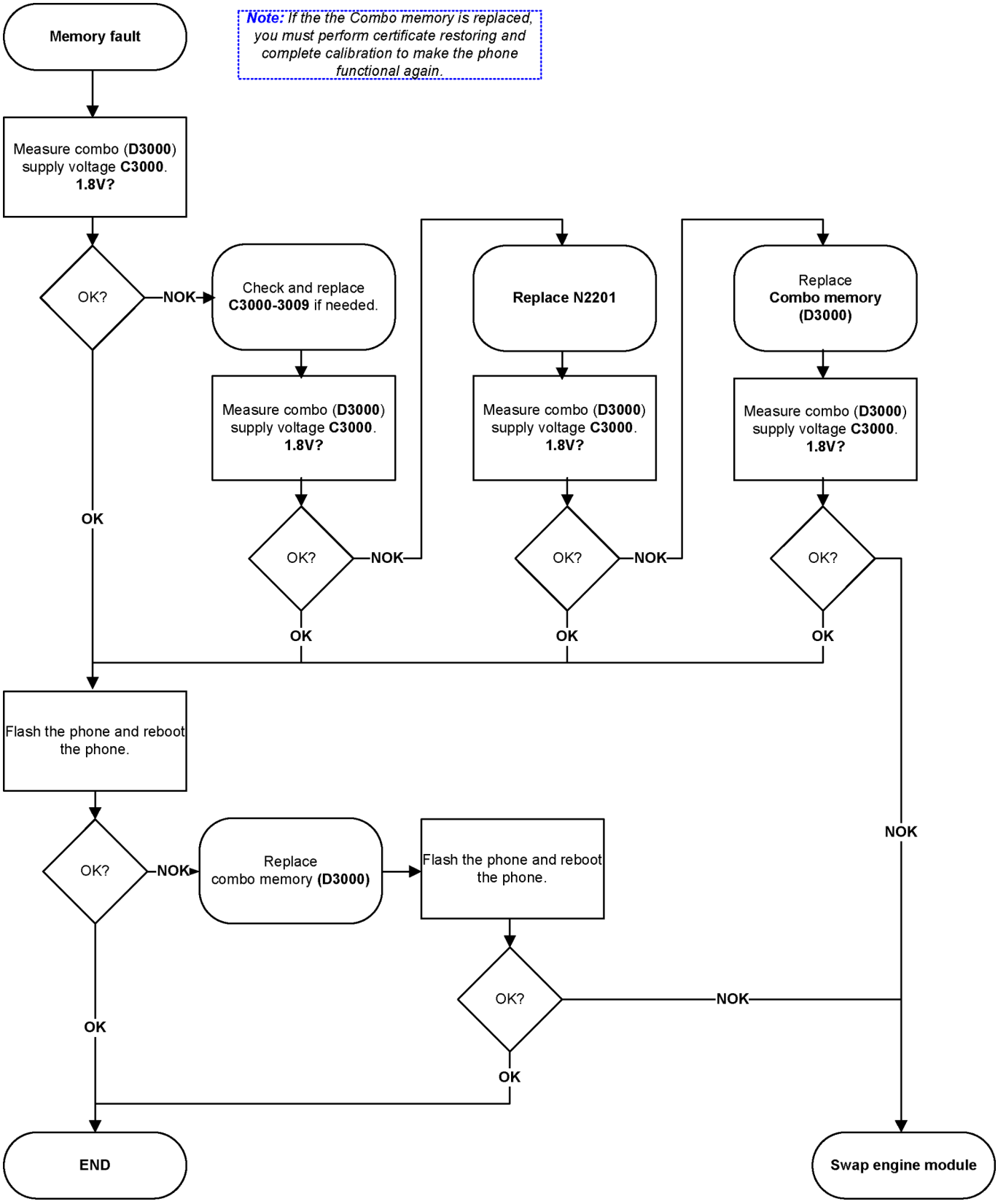
Combo memory troubleshooting

Troubleshooting flow



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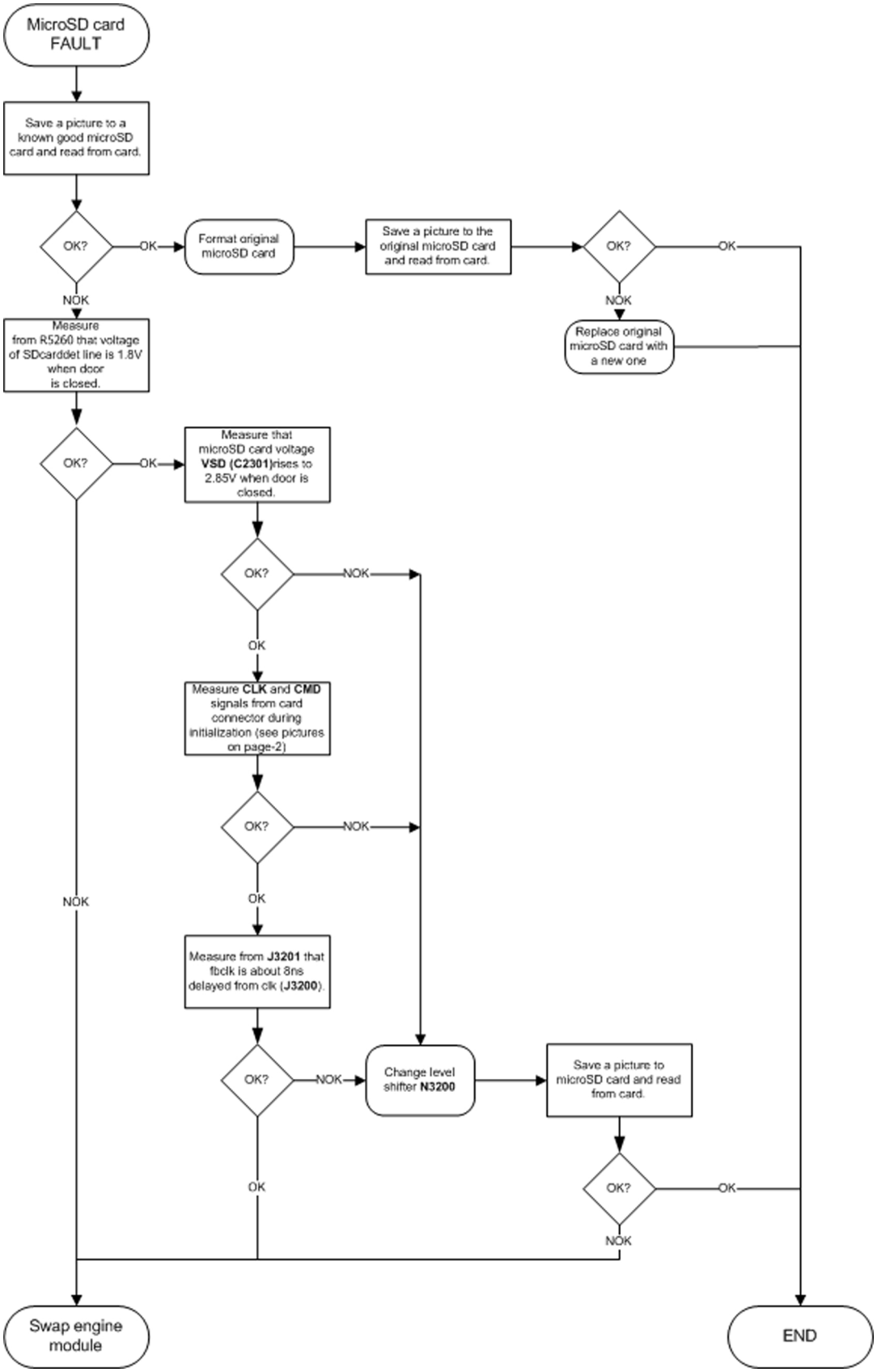
MicroSD card troubleshooting

Troubleshooting flow



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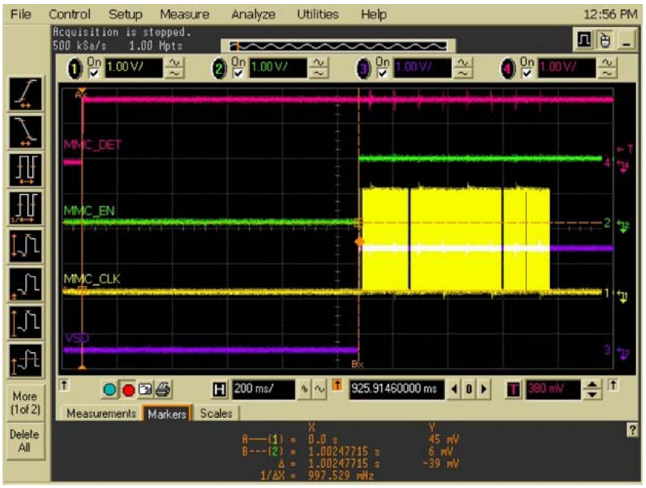
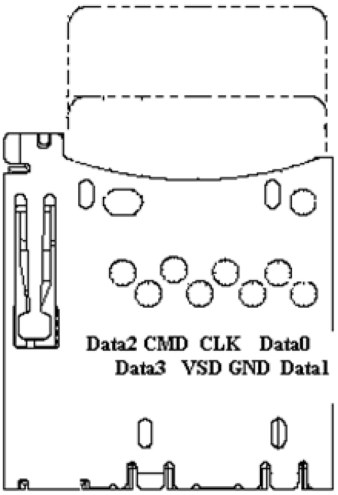
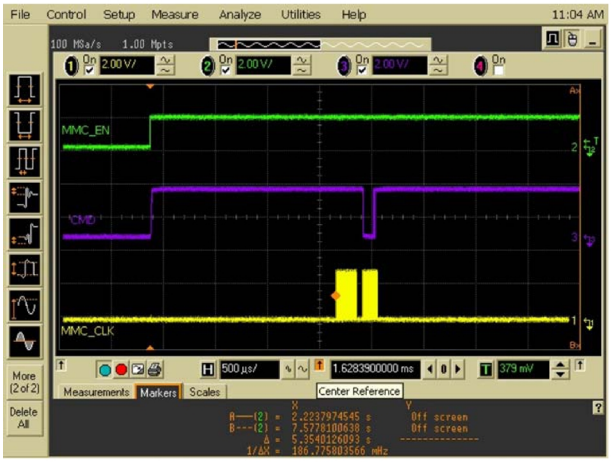


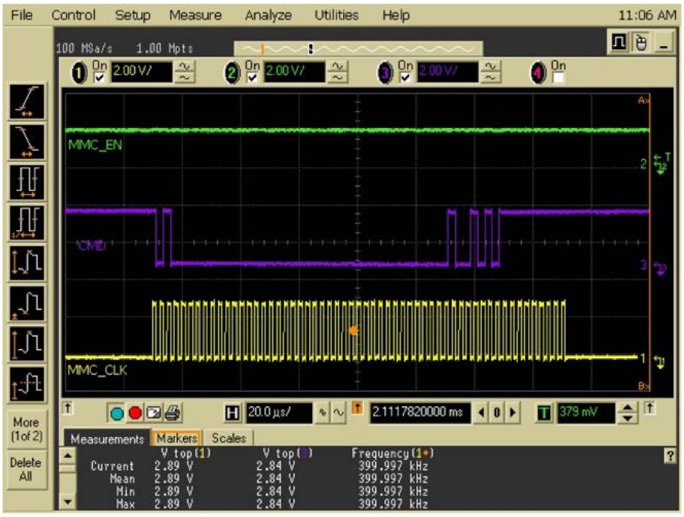
MicroSD interface signals timing when door is closed.



MicroSD connector



CLK and CMD signals during card initiaisation when card is not inserted. Measured from the microSD connector.



CLK and CMD signals during card initiaisation when card is not inserted. Measured from the microSD connector

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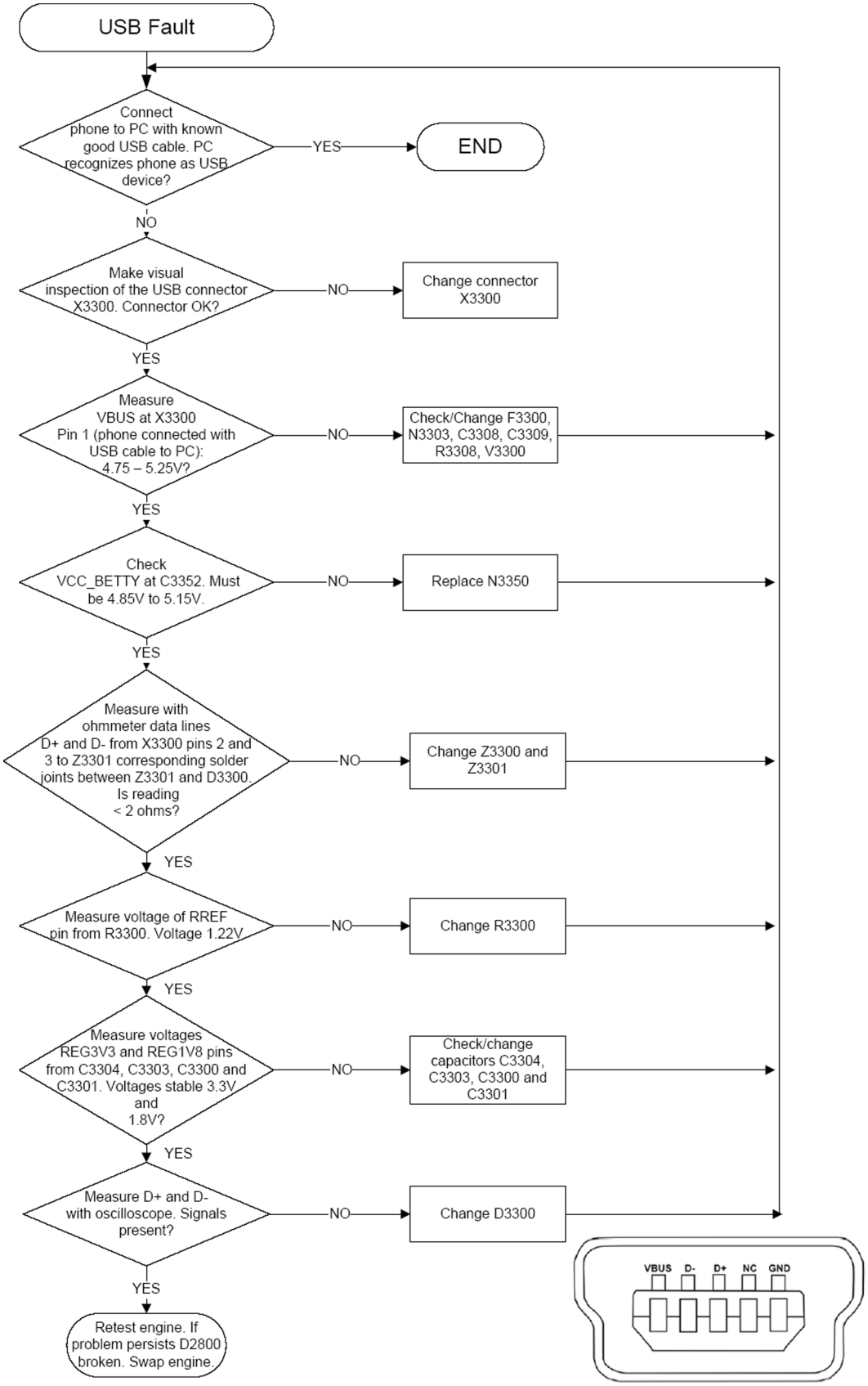
USB troubleshooting

Troubleshooting flow



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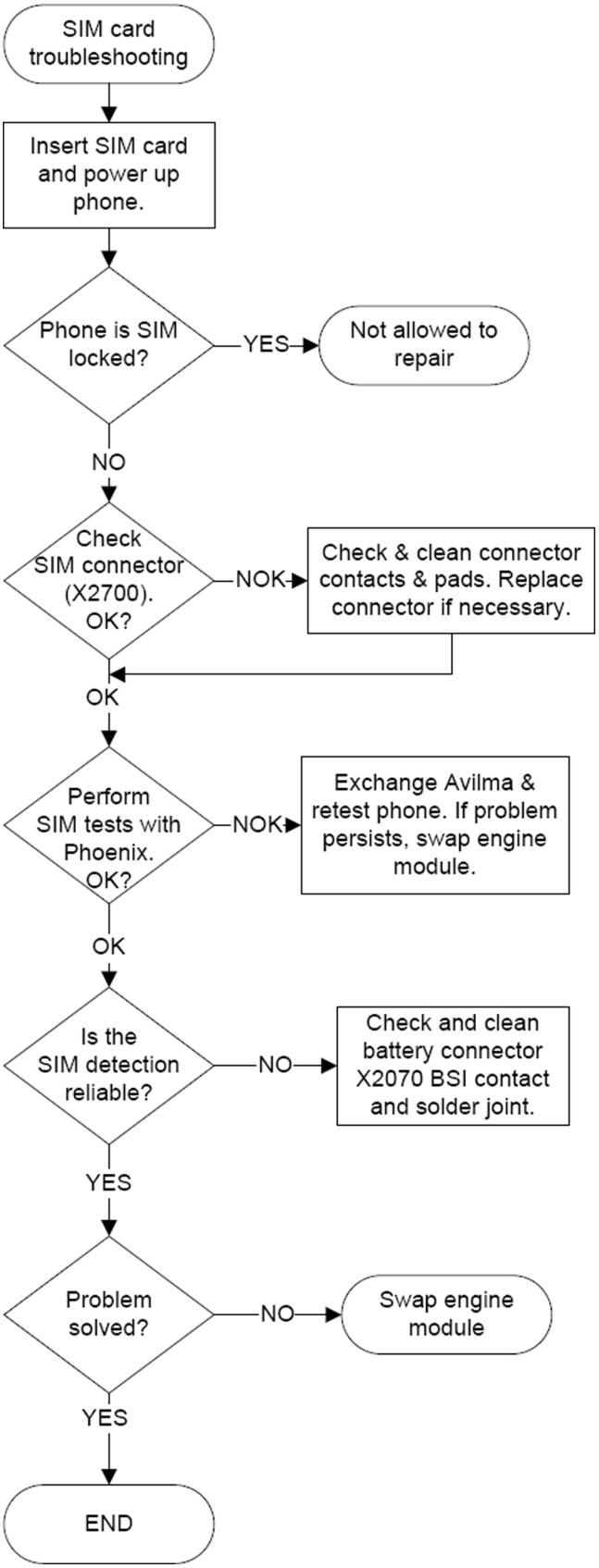
SIM card troubleshooting

Troubleshooting flow



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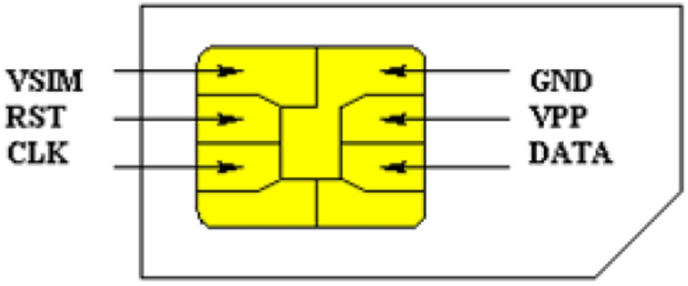
Use module jig when measuring SIM signals. The SIM connector X2700 pins are used as measuring points.



SIM contacts

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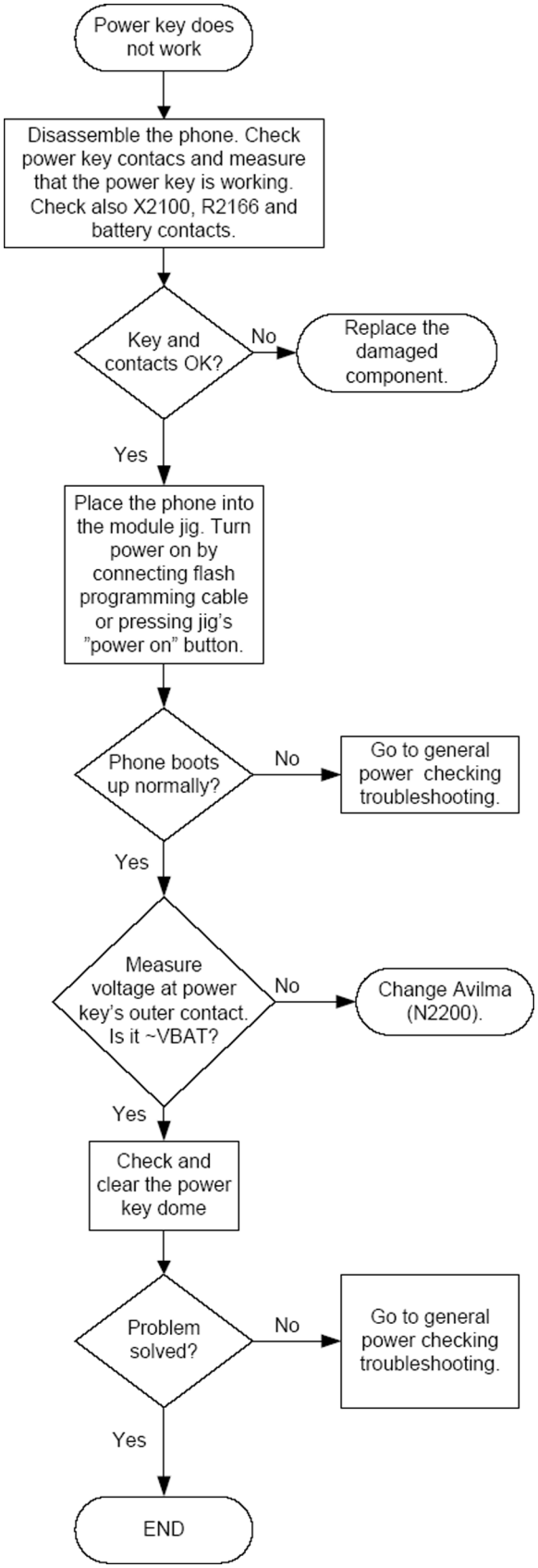
Power key troubleshooting

Troubleshooting flow



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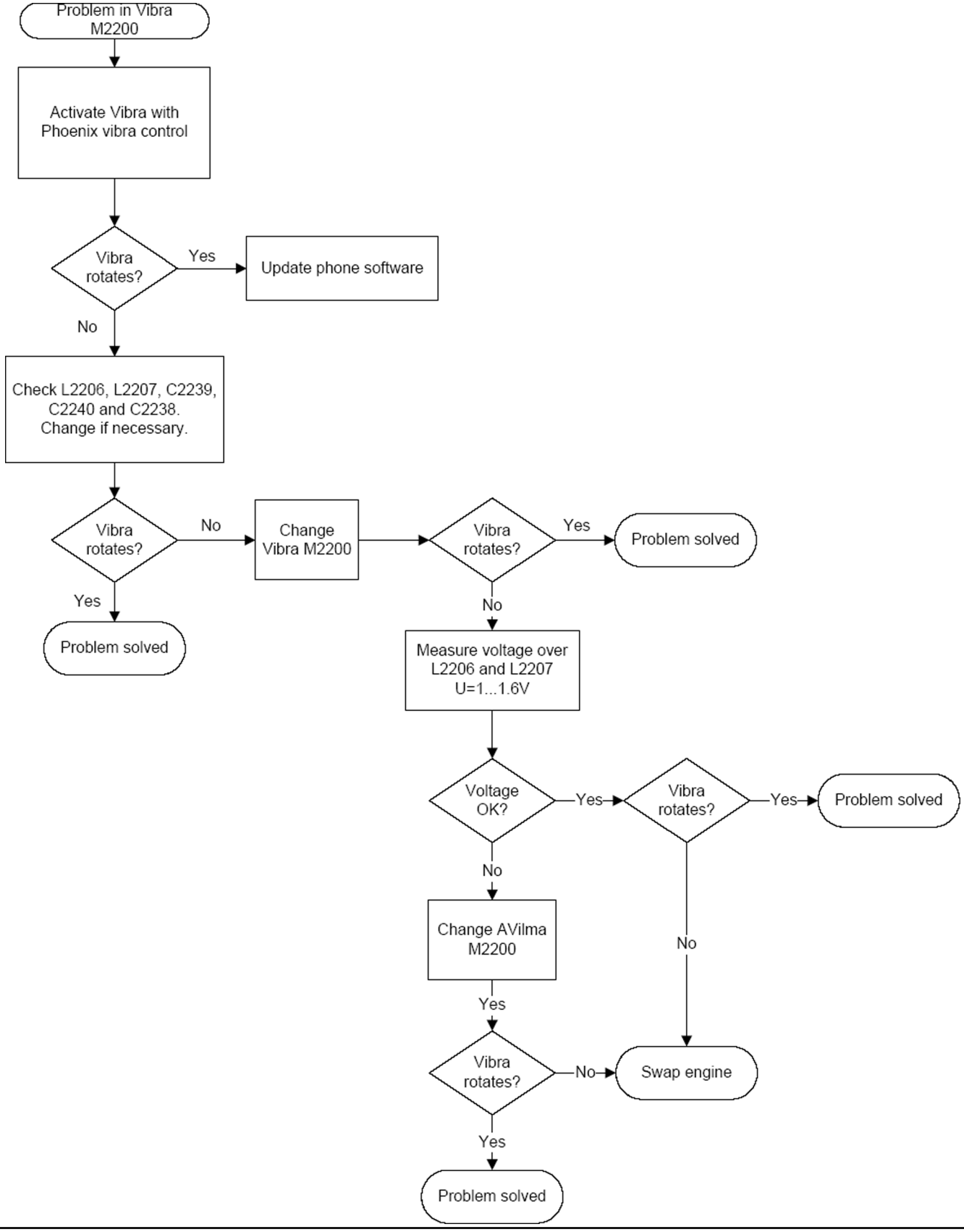
Vibra troubleshooting

Troubleshooting flow



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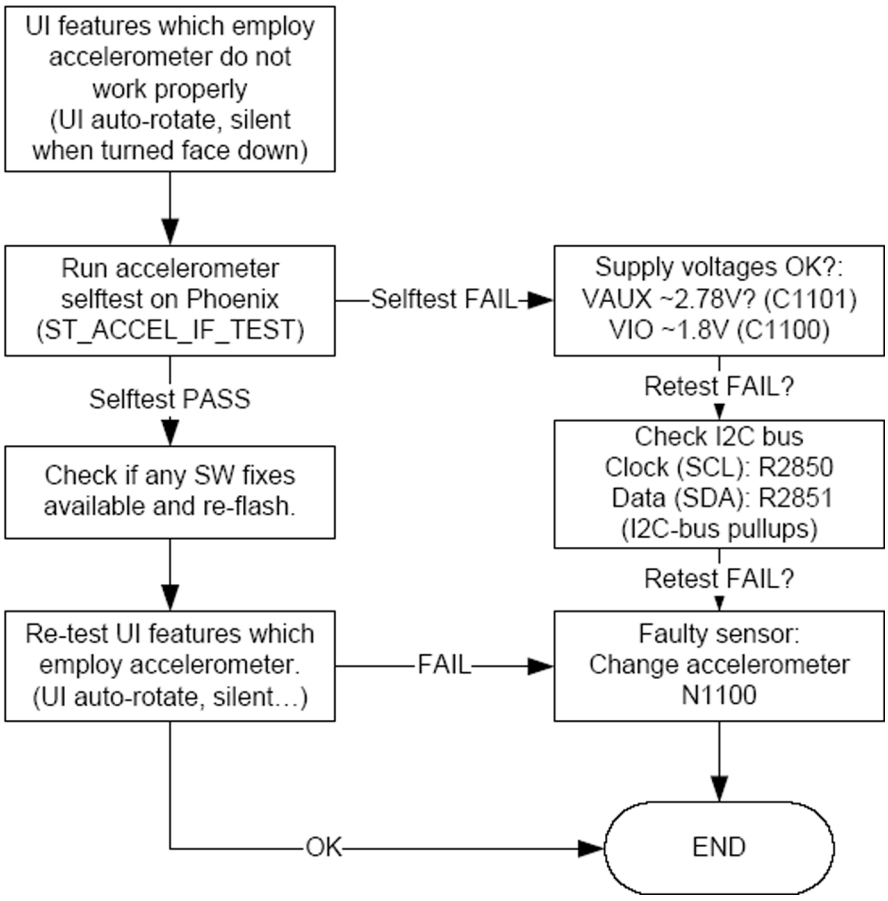
Accelerometer troubleshooting

Troubleshooting flow

Accelerometer selftest: (ST_ACCEL_IF_TEST) verifies the digital parts and the sensor elements inside the component. Selftest is available in LOCAL and TEST modes.

Note! The phone needs to be stable when running the selftest to get correct results. If changes in acceleration are detected by component during the test, it may cause the selftest to fail.



Touch screen troubleshooting

Introduction to touch screen troubleshooting

The device has a resistive touch screen user interface, which means that the device does not have a traditional ITU-T keypad. The key components of the touch screen user interface are:

- Touch window with touch controller (TSC2004)
- Proximity sensor

The resistive touch window is located above the display. It enables finger as well as stylus touch, and it provides tactile feedback. The tactile feedback is implemented by using the same vibra that is used for alerting. The touch controller includes drivers and the control logic to measure touch pressure.

The proximity sensor is attached to the upper flex assembly. It sends out a beam of IR light, and then computes the distance to any nearby objects from the characteristics of the returned (reflected) signal. There is a booth between the sensor and the touch window, which isolates the IR transmitter from the IR receiver by preventing the reflection from the touch window surface.

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Proximity sensor troubleshooting

Context

Proximity sensor troubleshooting is broken down into two parts. The main purpose of the automatic check is to identify the fault automatically without any manual checks. If the automatic flow does not provide enough information, a manual check can be done to narrow down the cause of the fault.

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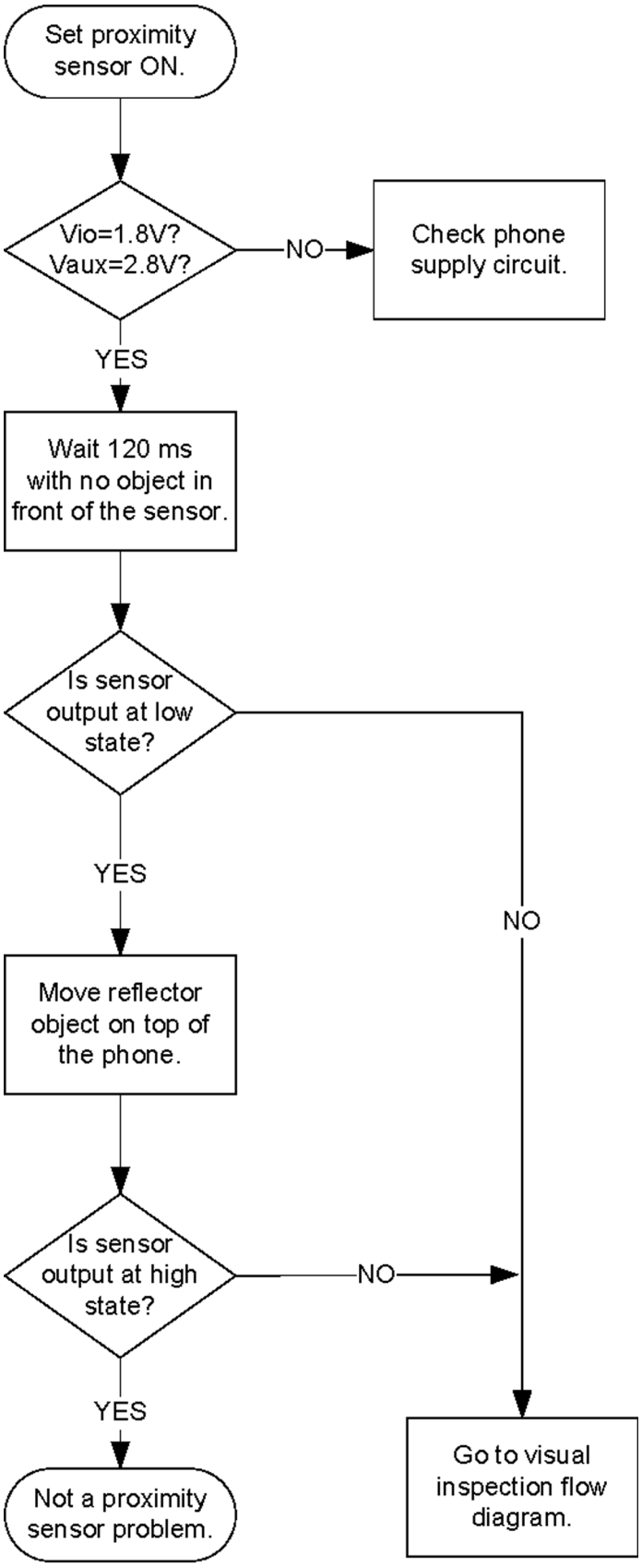
Troubleshooting flow



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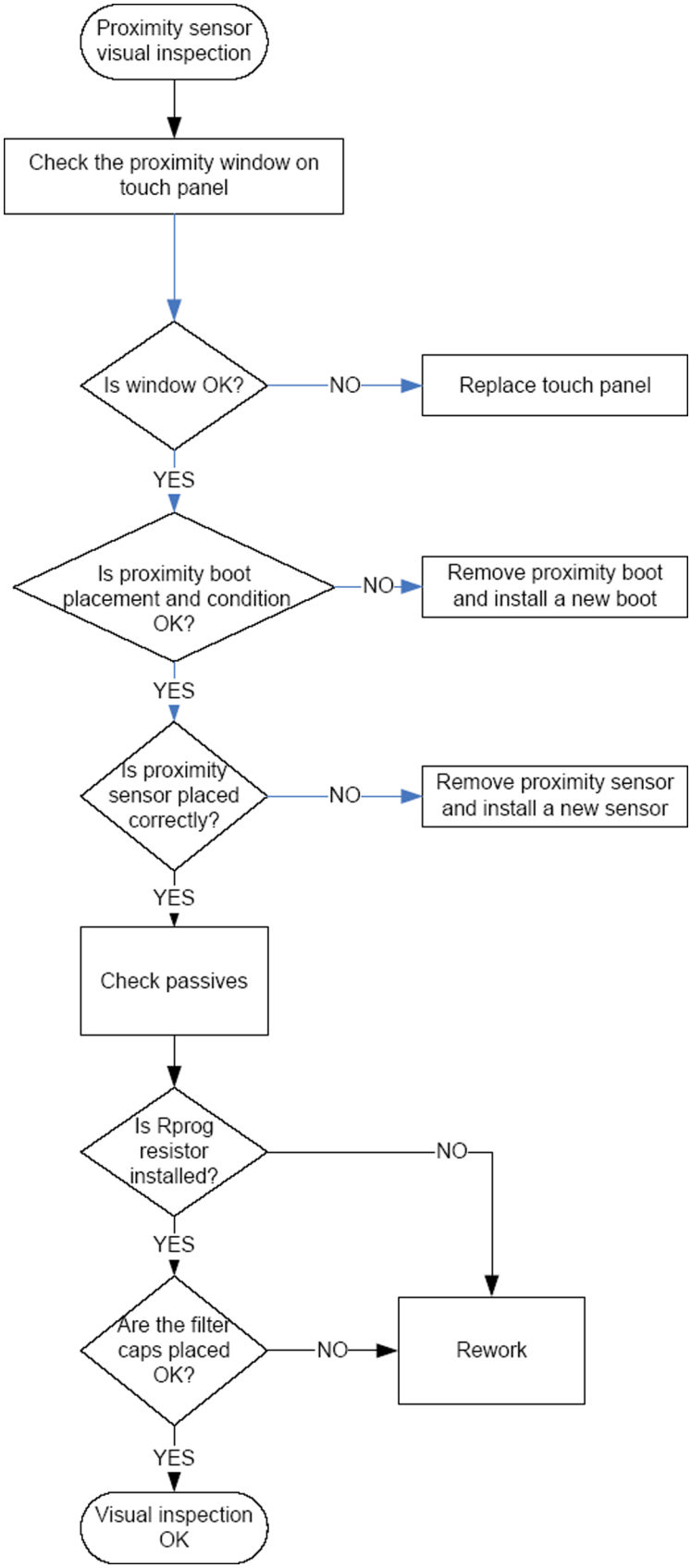

Figure 18 Proximity sensor troubleshooting - part 2

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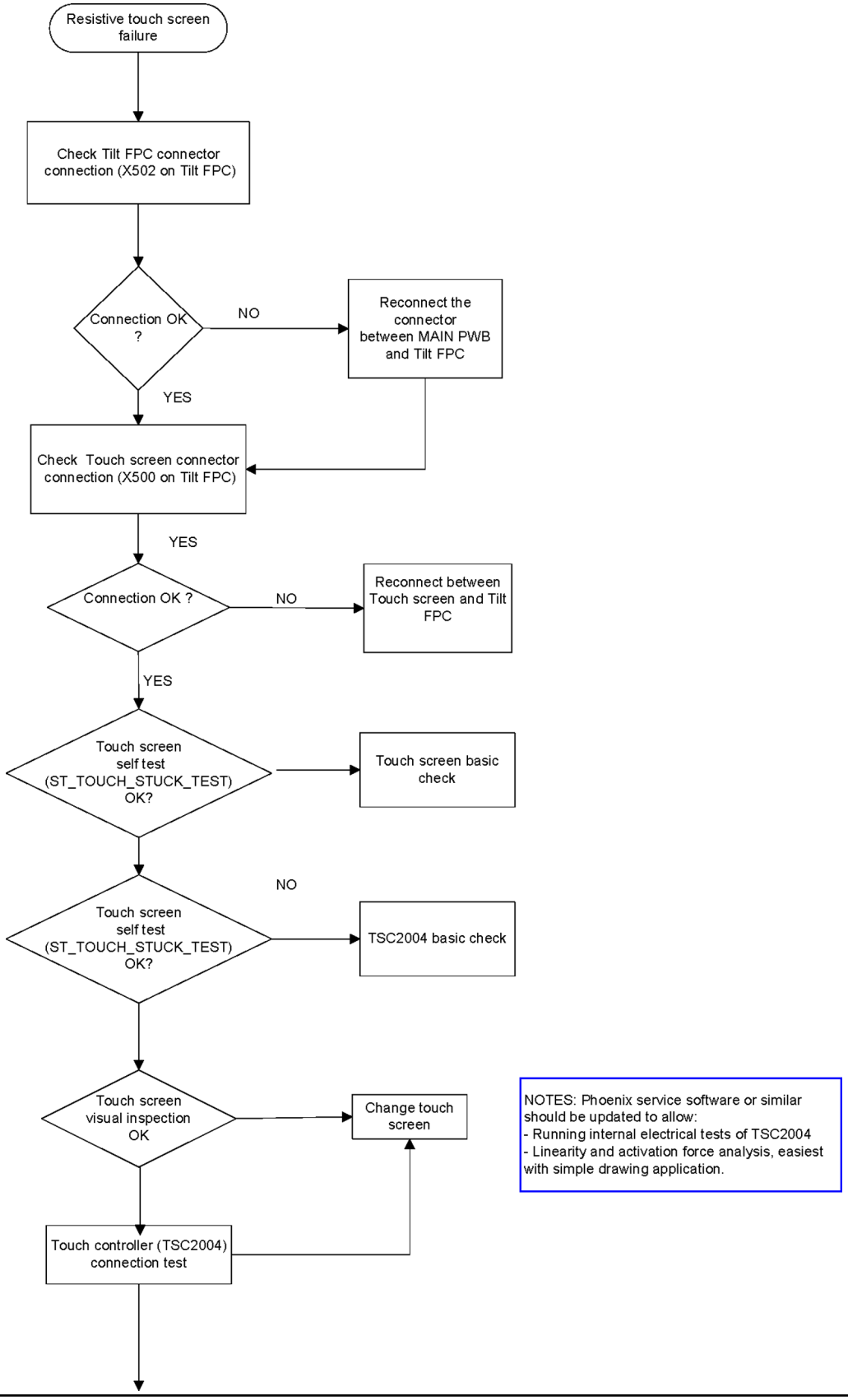
Resistive touch screen troubleshooting

Troubleshooting flow



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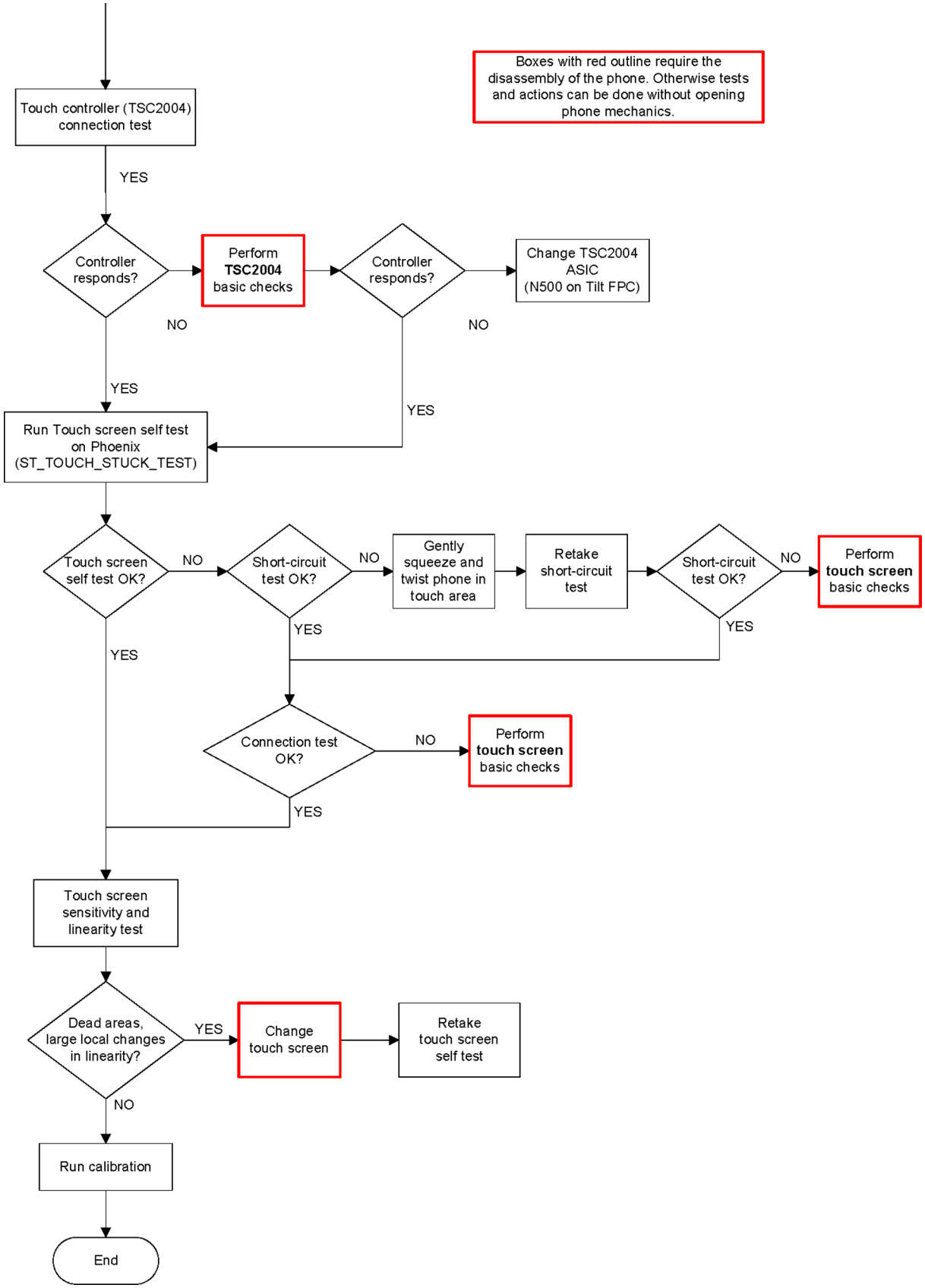

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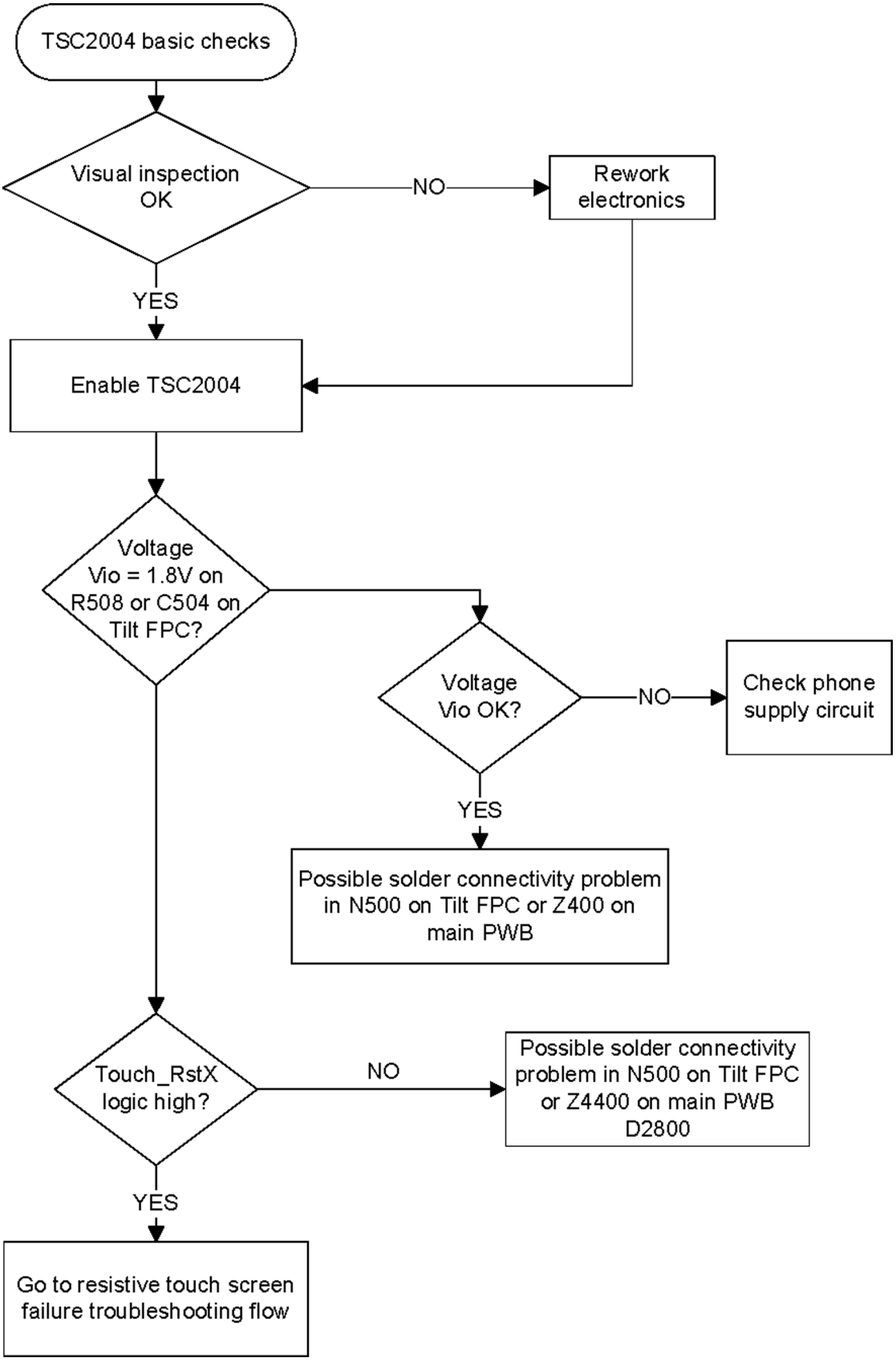

Figure 19 Touch controller basic checks

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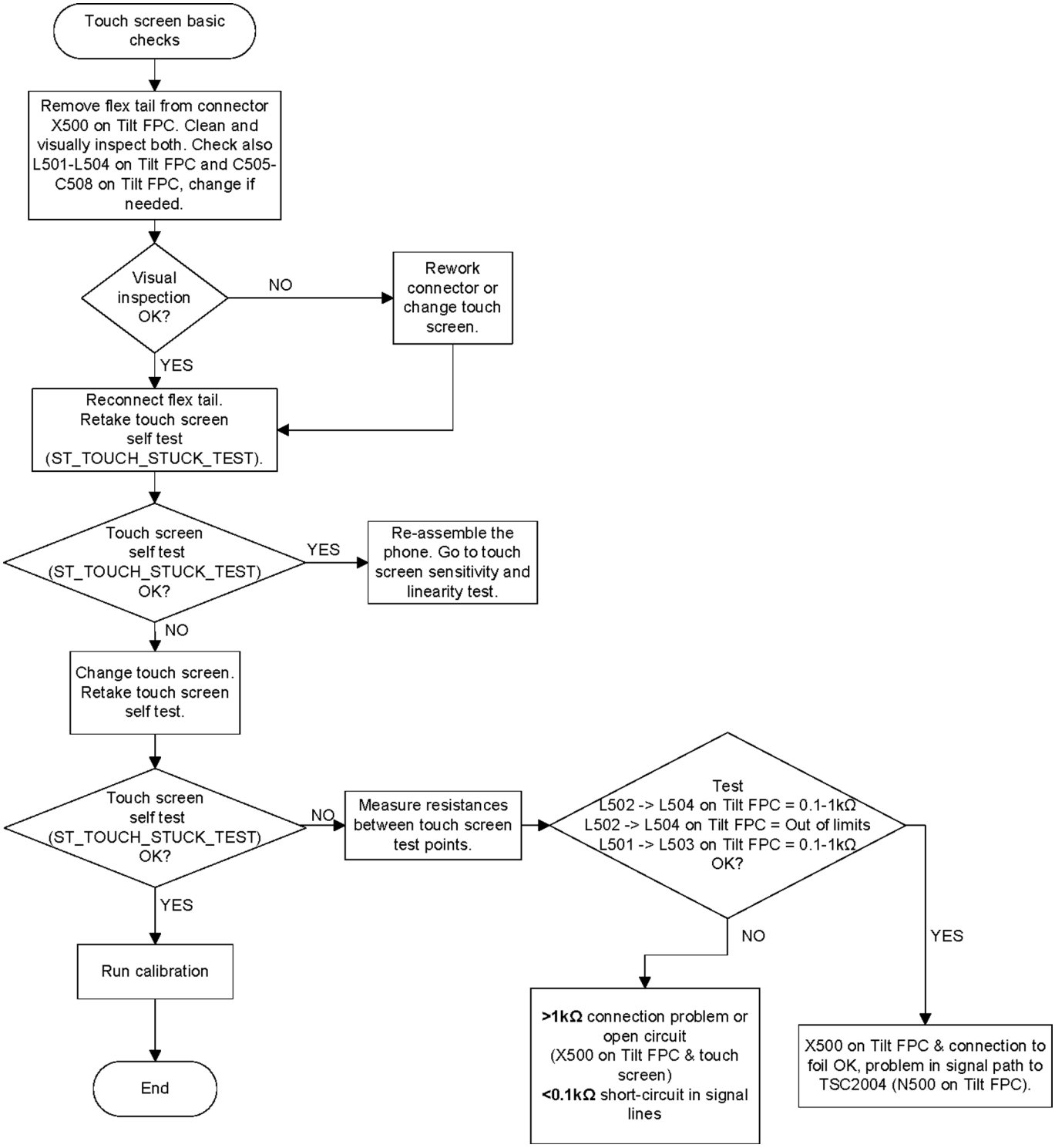

Figure 20 Touch screen basic checks

Hardware keys troubleshooting

Context

There are two possible failure modes in the keyboard module:

- One or more keys can be stuck, so that the key does not react when a keydome is pressed. This kind of failure is caused by mechanical reasons (dirt, rust).

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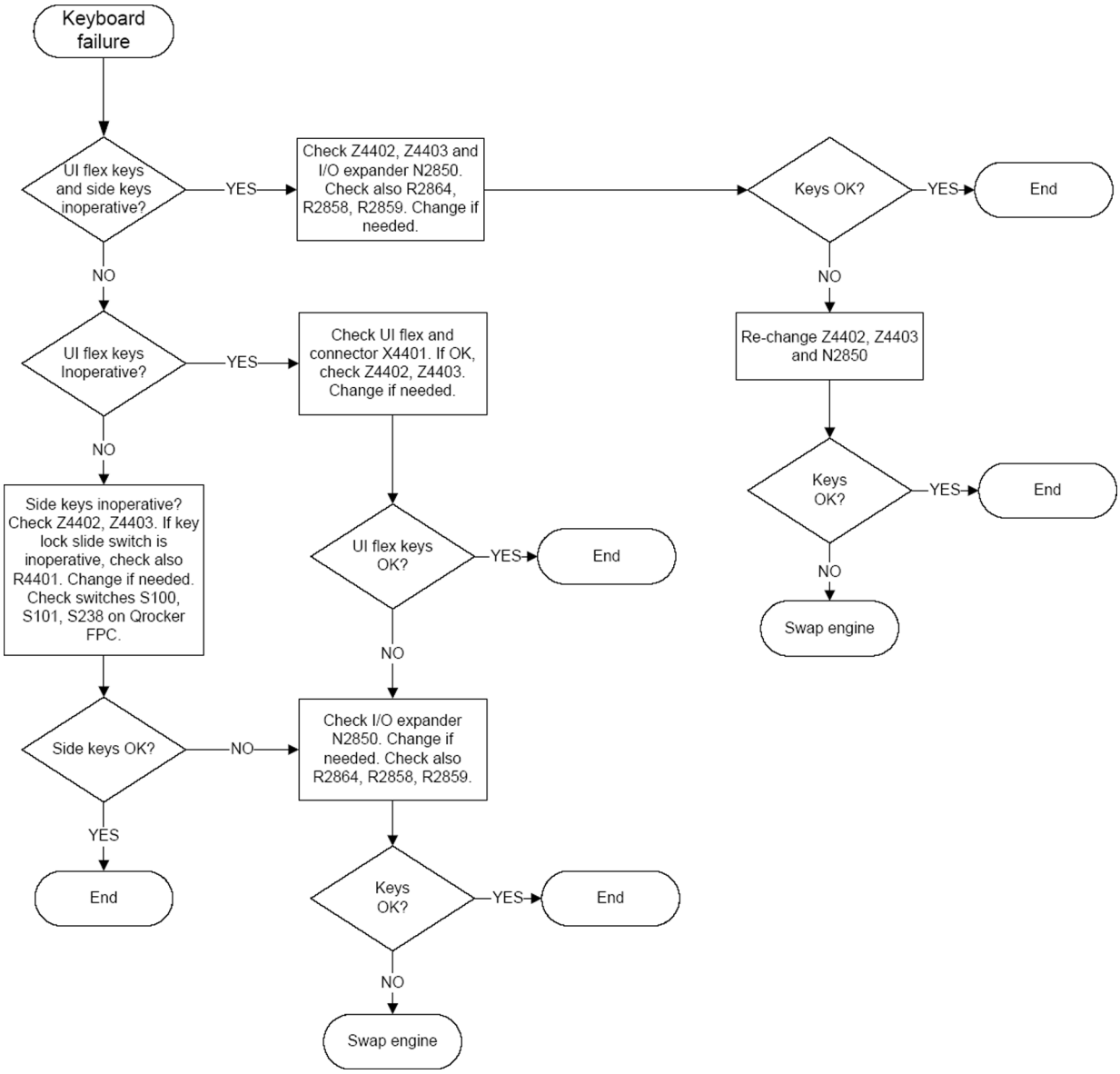
- Malfunction of several keys at the same time; this happens when one or more rows or columns are failing (shortcircuit or open connection).

If the failure mode is not clear, start with the Keyboard Test in Phoenix.

Troubleshooting flow



Expander's PIN		Keypad-IO-Y0	Keypad-IO-Y1	Keypad-IO-Y2	Keypad-IO-Y3	Keypad-IO-Y4	Keypad-IO-Y5	Keypad-IO-Y6	Keypad-IO-Y7	Keypad-IO-Y8	SF keys
	Line	COL0	COL1	COL2	COL3	COL4	COL5	COL6	COL7	COL8	SF
Keypad-IO-X0	ROW0	Q	W	E	R	T	Y	U	Back	Select	Cam half
Keypad-IO-X1	ROW1	A	S	D	F	I	O	Enter	P	Space	Cam full
Keypad-IO-X2	ROW2	Z	X	G	H	K	L	J	..	Chr	
Keypad-IO-X3	ROW3	Shift	C	V	B	Menu	M	N	Vol+	Fn	
Keypad-IO-X4	ROW4	Down	up	Left	Right				Vol-		

Figure 21 Keymatrix

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Display module troubleshooting

General instructions for display troubleshooting

Context

- The display is in a normal mode when the phone is in active use.
- Display is in a partial idle mode when the phone is in the screen saver mode.
- The operating modes of the display can be controlled with the help of *Phoenix*.

Table 7 Display module troubleshooting cases

Display blank	There is no image on the display. The display looks the same when the phone is on as it does when the phone is off. The backlight can be on in some cases.
Image on the display not correct	Image on the display can be corrupted or a part of the image can be missing. If a part of the image is missing, change the display module. If the image is otherwise corrupted, follow the appropriate troubleshooting diagram.
Backlight dim or not working at all	Backlight LED components are inside the display module. Backlight failure can also be in the connector or in the backlight power source in the main engine of the phone.
Visual defects (pixel)	Pixel defects can be checked by controlling the display with Phoenix. Use both colours, black and white, on a full screen. The display may have some random pixel defects that are acceptable for this type of display. The criteria when pixel defects are regarded as a display failure, resulting in a replacement of the display, are presented the following table.

Table 8 Pixel defects

<table>
<tr><th>Item</th><th></th><th colspan="4">White dot defect</th><th>Black dot defect</th><th>Total</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Defect counts</td><td>R</td><td>G</td><td>B</td><td>White Dot Total</td><td rowspan="2">1</td><td rowspan="2">1</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>2</td><td>Combined defect counts</td><td colspan="6">Not allowed.
Two single dot defects that are within 5 mm of each other should be interpreted as combined dot defect.</td></tr>
</table>

Steps

1. Verify with a working display that the fault is not on the display module itself.

   Note: The display module cannot be repaired.

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2. Check that the cellular engine is working normally.
   i To check the functionality, connect the phone to a docking station.
   ii Start *Phoenix* service software.
   iii Read the phone information to check that the engine is functioning normally (you should be able to read the Phone ID).
3. Proceed to the display troubleshooting flowcharts.
   Use the **Display Test** tool in *Phoenix* to find the detailed fault mode.

Display troubleshooting

Context

Before going to display troubleshooting flow, make sure that the engine is working and starting up correctly. If the problem is in the engine, go to baseband troubleshooting.

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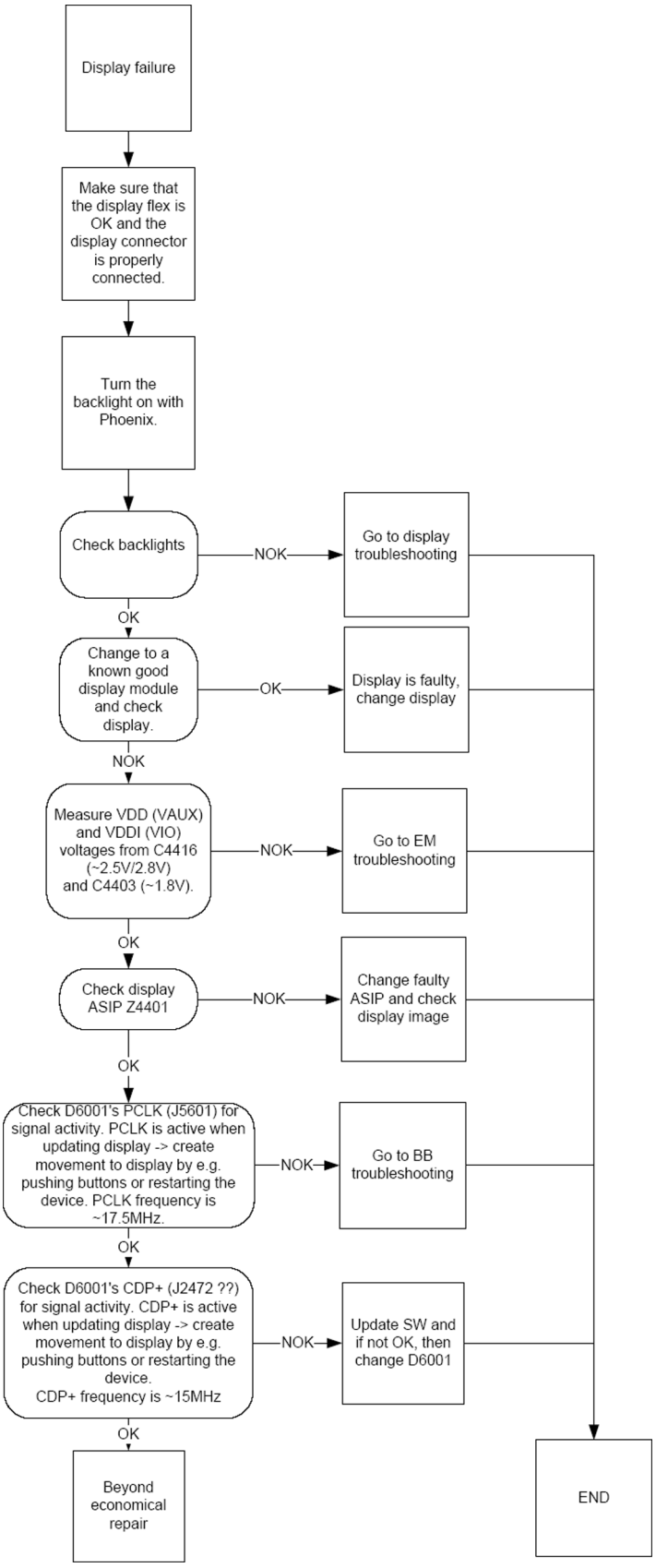
Troubleshooting flow



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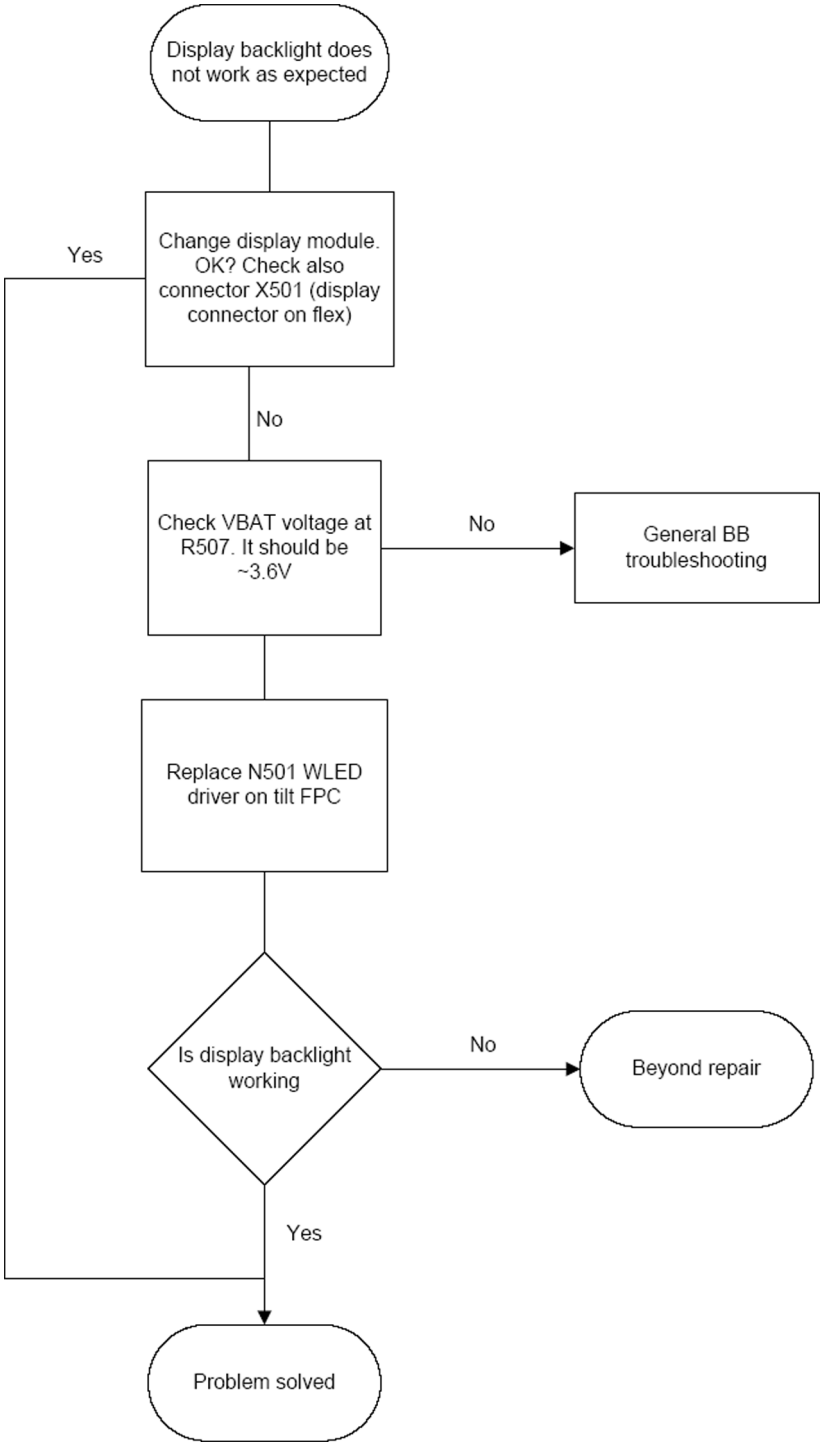
Display backlights troubleshooting

Context

The device has a dedicated display WLED driver whose intensity is controlled by Display itself by CABC (content adaptive backlight control) signal.

Troubleshooting flow



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LED and LED driver troubleshooting

Context

The device has two LED drivers that provide current for the keyboard and several LEDs (Charge,Send/end,menu) . Brightness of backlights can be adjusted manually, and it affects the keypad. Keyboard backlights and some LEDs can be turned ON/OFF separately but not without switching on the display lights.

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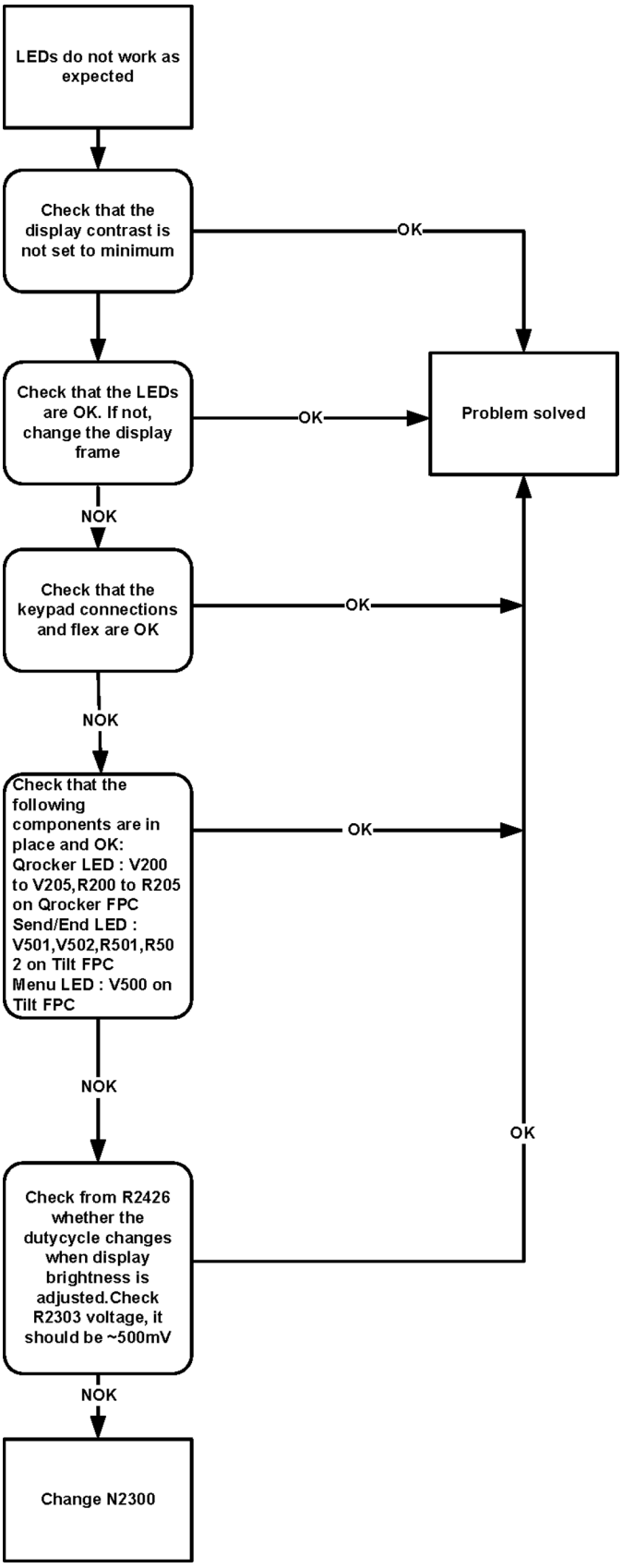
Troubleshooting flow



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Ambient Light Sensor troubleshooting

Introduction to ALS troubleshooting

If the Ambient Light Sensor (ALS) functionality is inoperative, check the ambient light sensor (N6502) and change it, if necessary. Also, check the capacitor C6504 (100n).

The ALS components are located at the top of the UI flex as illustrated in the figure below.

Figure 22 ALS placement

GPS troubleshooting

GPS antenna

The GPS antenna is located on the back side of the B-cover (left-hand side, next to the camera). The GPS antenna contacts the GPS antenna pad (connected to the ground) on PWB through the poco pin (in the B-cover, above the camera).

Figure 23 GPS antenna

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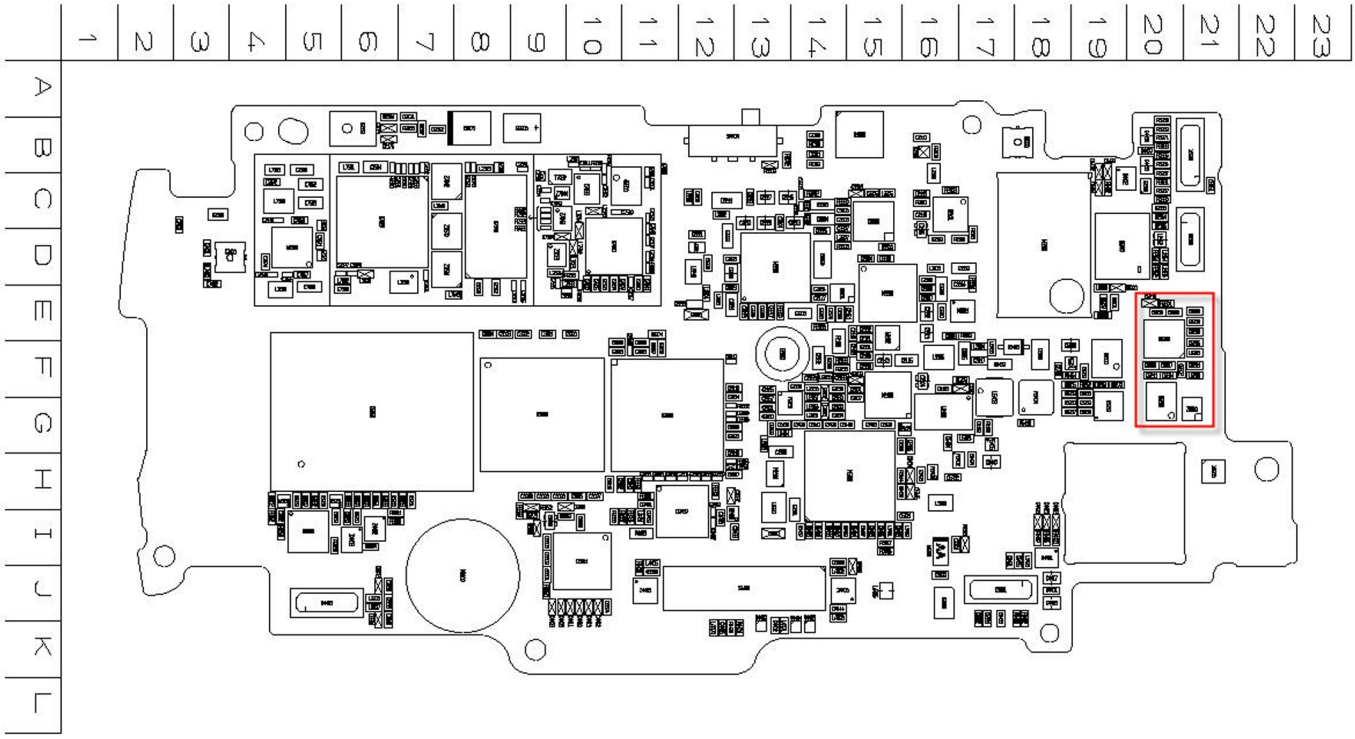
Figure 24 GPS poco pin

GPS layout and basic test points



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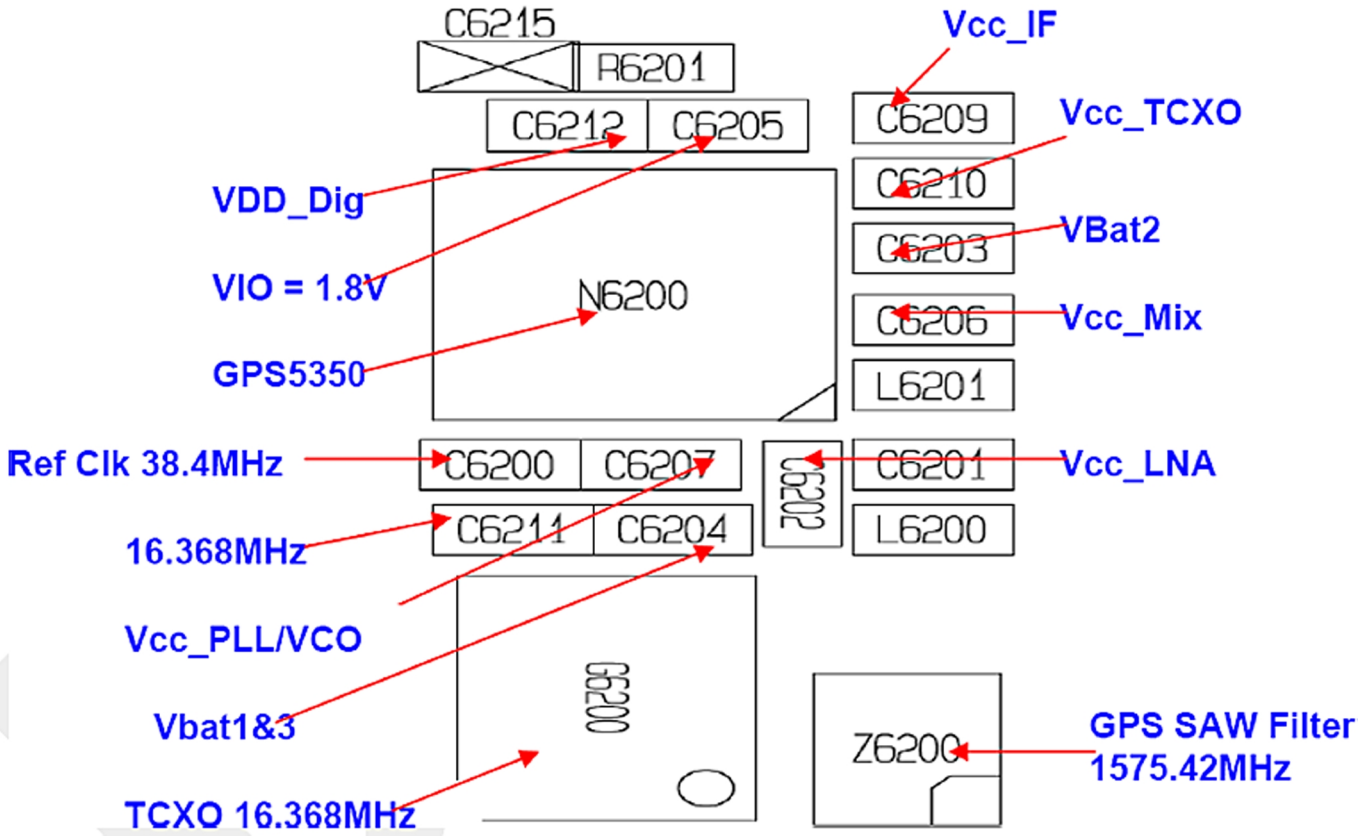

Figure 25 GPS layout and basic test points

VBat, ASIC internal LDO voltages, and clocks are available as shown in figure above. In addition to these, the following GPS signals are available on the test points listed below:

- U2Tx (J6200, activity on this pin indicates the GPS is operating)

GPS RF test points

The GPS test pads are located on the top side as shown in figure "GPS test pads" to perform the conducted CW test to confirm the GPS RF path from GPS chipset to the GPS SAW filter.

J6201 is the pad to inject the CW signal

J6202, J6203 = Gnd

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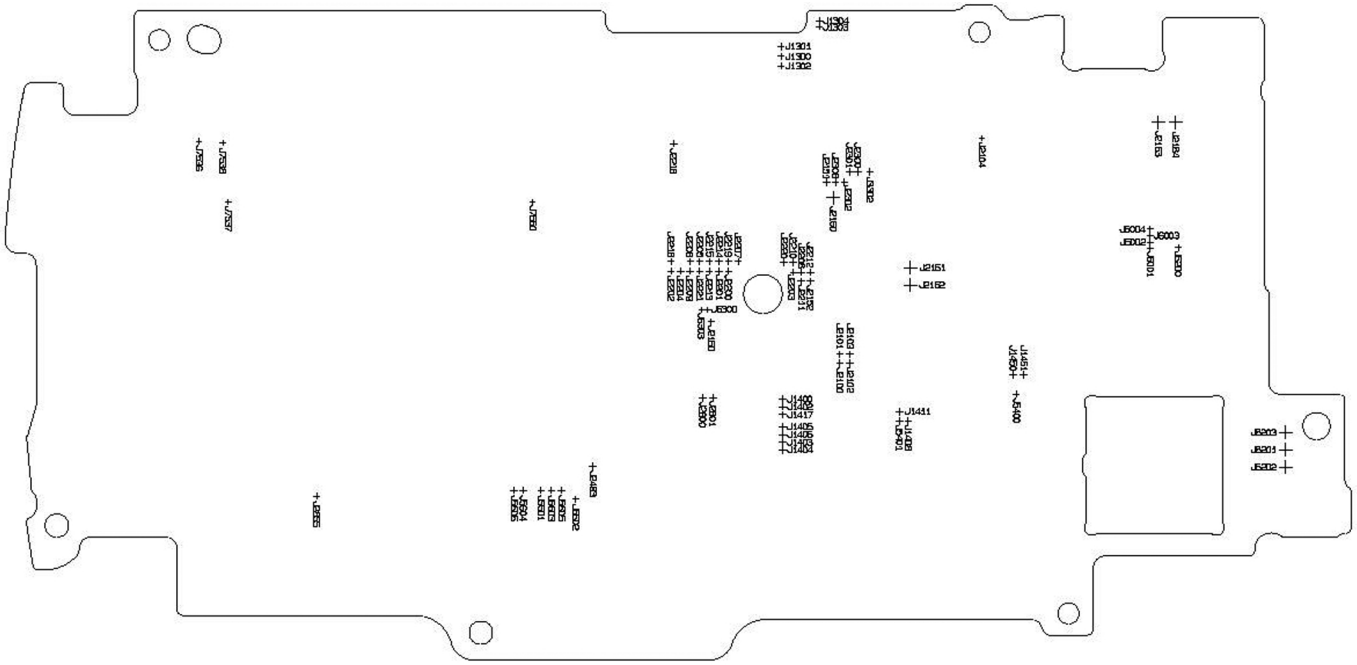

2UZ_08a_tatdrw_t.pdf

Figure 26 GPS test pads

GPS settings for Phoenix

GPS control

Context

Use the following to test GPS using Phoenix.

Steps

1. Start Phoenix service software.
2. From the **File** menu, select **Scan Product** and check that the correct product version is displayed.
3. From the **Testing** menu, select **GPS Control**. This opens up *GPS Control* dialogue box, as shown in the figure below, and enables the GPS.

   Select **Idle** to confirm the GPS is enabled and is in idle mode; at this point all clocks should be present, GPS_En_Reset should be high (1.8V), and Vdd_Dig (1.1V), Vcc_TCXO (2.5V) & Vcc_PLL/VCO (1.35V) should be present. Turning **Receiver Action** *On* will turn on all the RF sections of the ASIC and so all LDOs will be on.

   Note: These checks are part of GPS basic checks troubleshooting (page 3–50)

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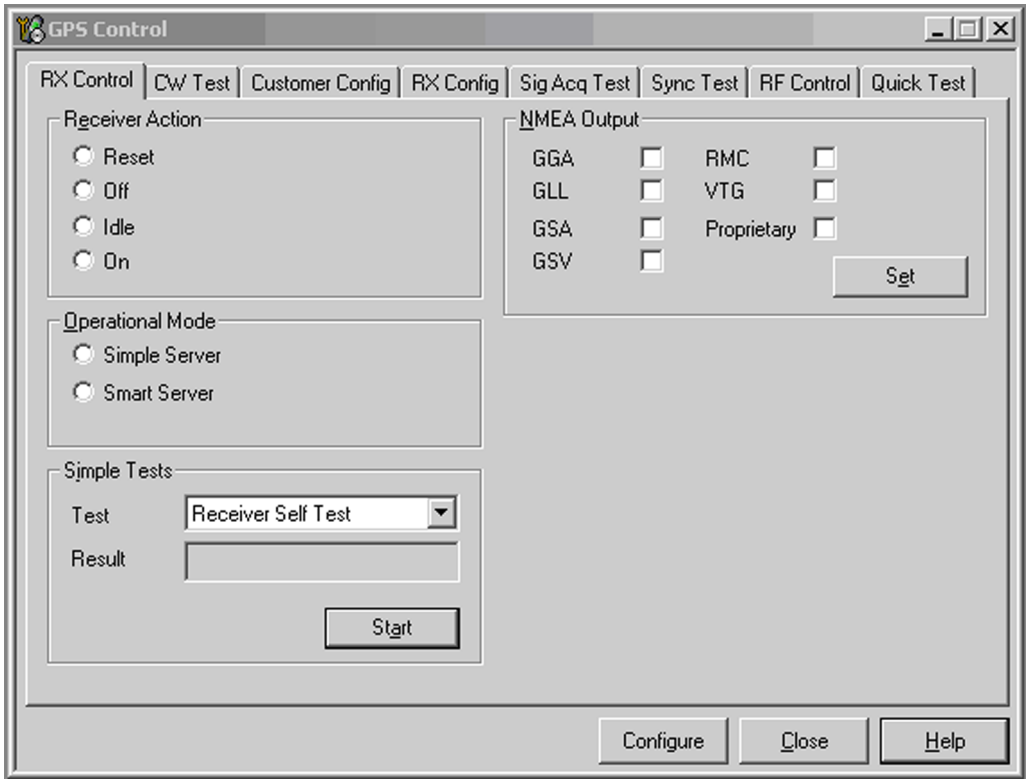

Figure 27 GPS Control dialog box

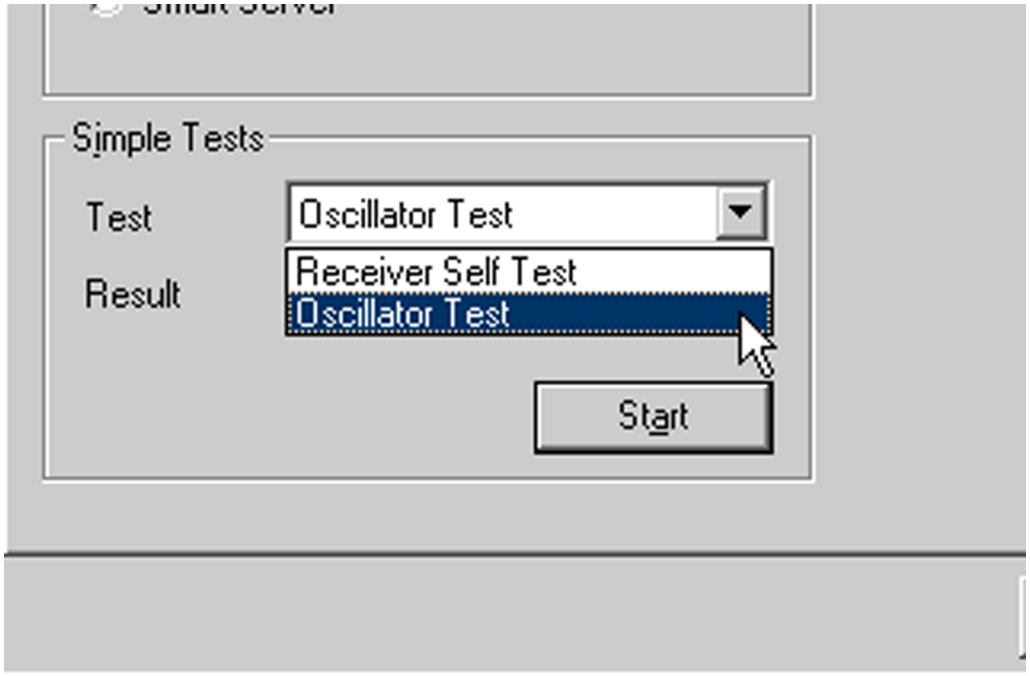

Figure 28 Simple Tests – Oscillator Test & Receiver Self Test

Oscillator test

Context

The 16.368 MHz GPS Clk is compared against the CE Ref Clk and the output is the GPS Clk offset.

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Steps

1. Start Phoenix service software.
2. From the **Testing** menu, select **GPS Control**. This opens up *GPS Control* dialogue box and enables the GPS.

   In the *Rx Control* window, go to the **Simple Tests** section, select **Oscillator Test** and click **Start**. The Offset result will be returned and should be within the limits of +- 84Hz.

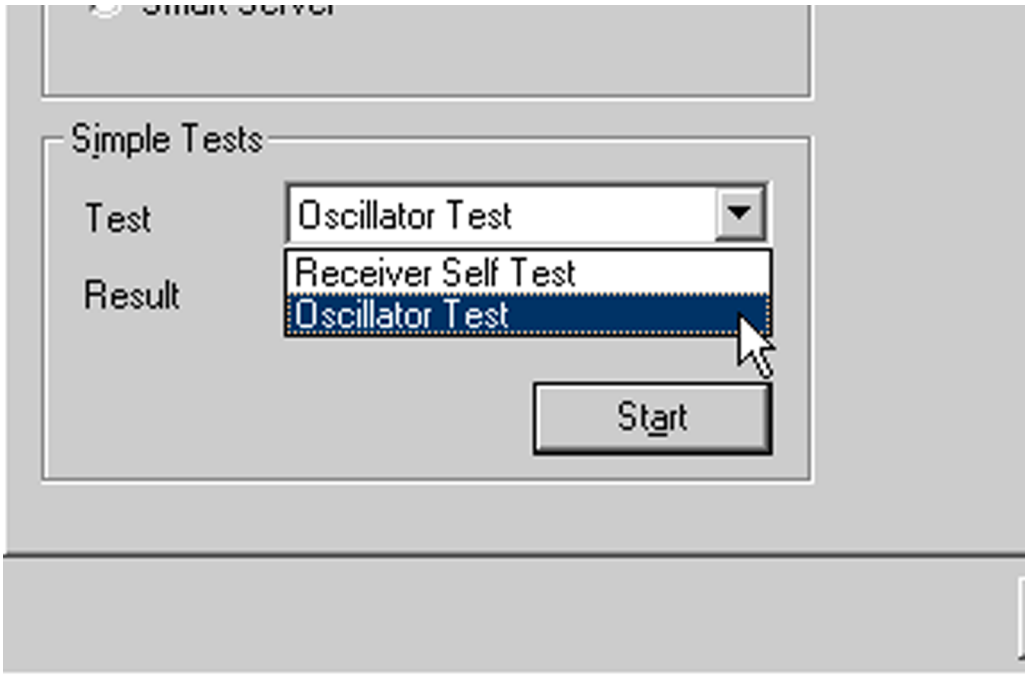

Figure 29 Simple Tests – Oscillator Test

Receiver self test

Context

Receiver self test can be used to check the correct functionality of the receiver core. For the test, GPS software configures internal test source to generate synthetic GPS-like data, processing it in the baseband and writing the results into the channel processor memory. The test compares the data in the channel memory against the expected value and reports a PASS/FAIL status.

Steps

1. Start Phoenix service software.
2. From the **Testing** menu, select **GPS Control**. This opens up *GPS Control* dialogue box and enables the GPS.

   In the *Rx Control* window, go to the **Simple Tests** section, select **Receiver Self Test** and click **Start**. The test returns a PASS/FAIL result.

   Note: The Oscillator Test should not be run after the Receiver Self Test. This sequence of tests may cause the Oscillator test to prolong and result in Phoenix timing out. If you are carrying out both of these tests, run the Oscillator Test first, after which you can run the Receiver Self Test.

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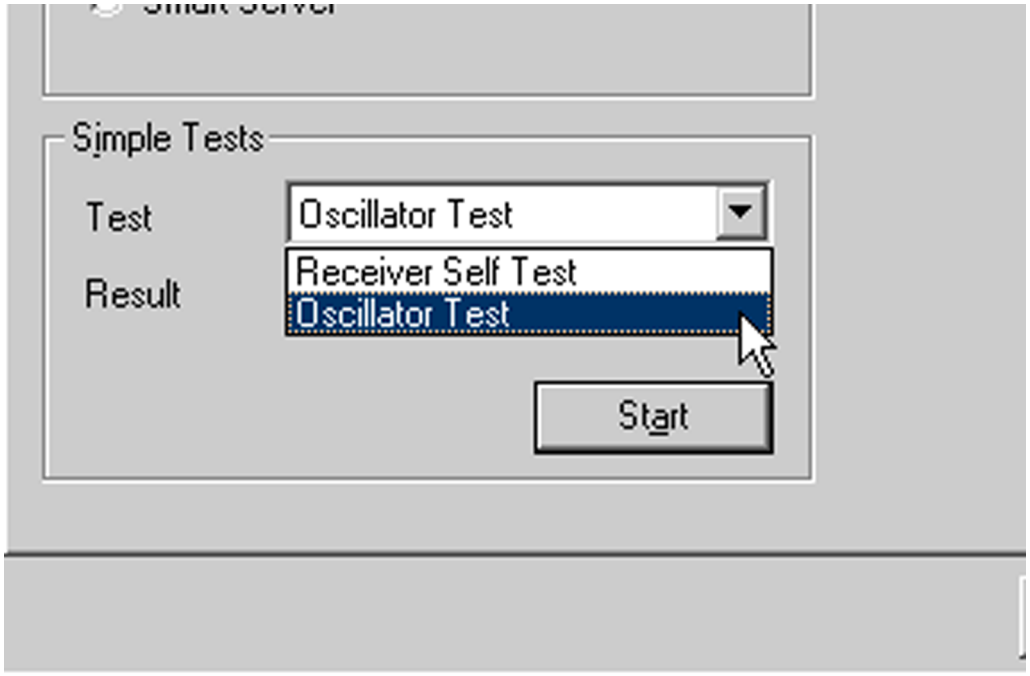

Figure 30 Simple Tests – Receiver Self Test

CW Test

Context

This test reports the SNR of a CW signal input to the GPS antenna port.

Steps

1. Start Phoenix service software.
2. From the **Testing** menu, select **GPS Control**. This opens up *GPS Control* dialogue box and enables the GPS.

   In the *CW Test* window, ensure that the input settings are as shown in the figure below. Inject 1575.520152 MHz tone at the GPS test pad J6201 at a level of -110dBm and click **Start**.

   For Pin = -110dBm and negligible other losses, the expected result ranges are:

   - Galvanic 29.8dB to 38.1dB
   - Radiated 25.8dB to 38.1dB

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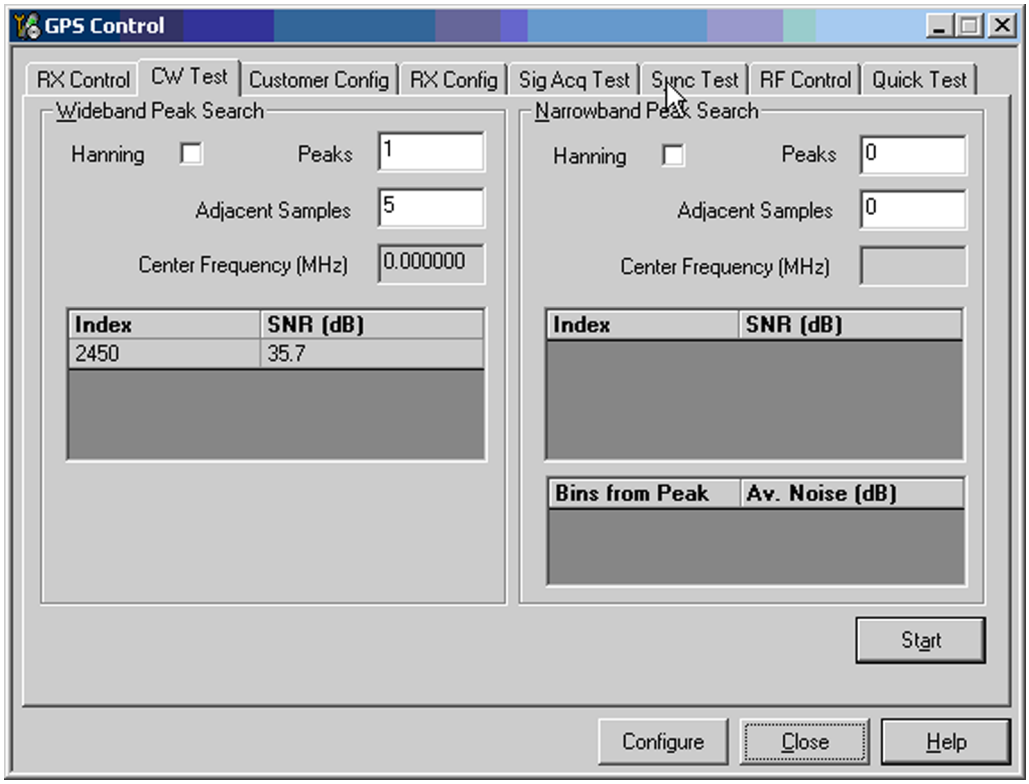

Figure 31 CW Test window

Quick Test window

Because the *Quick Test* runs the *Receiver Self Test* before the *Oscillator Test*, it may cause a timeout on the *Oscillator Test*. It does not necessarily mean that Oscillator Test has failed, but carrying out the Oscillator Test (page 3–45), Receiver Self Test (page 3–46) and CW Test (page 3–47) individually will give more valid results.

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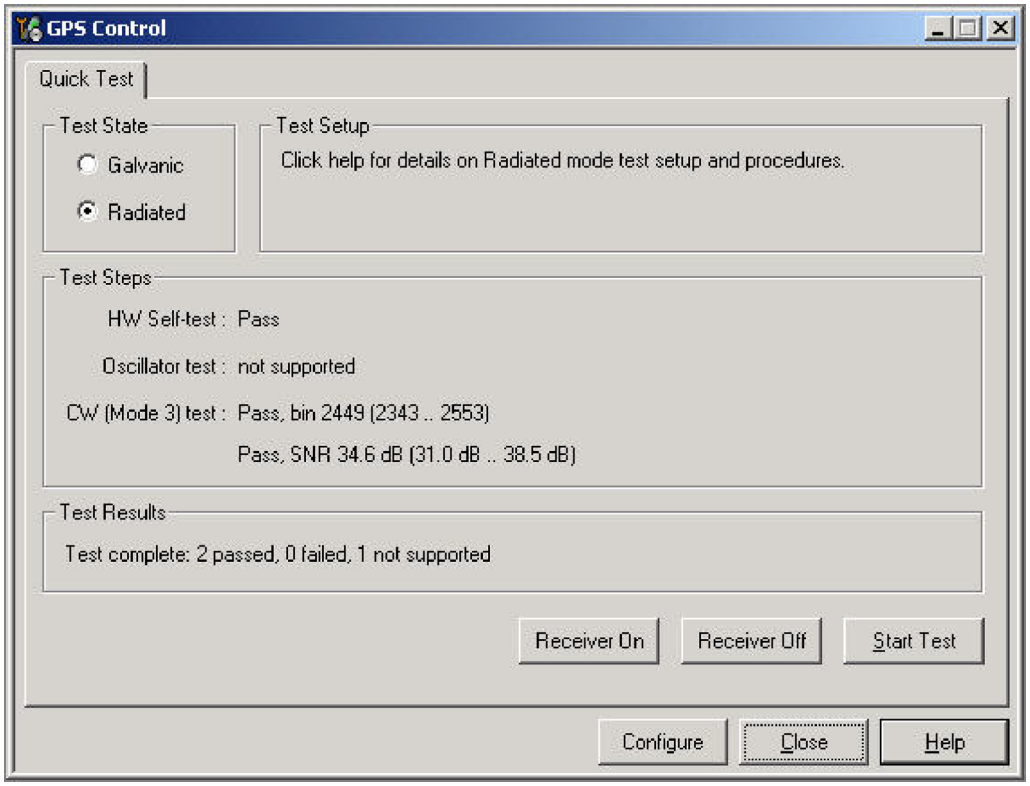

Figure 32 GPS Quick Test window for GPS troubleshooting

GPS failure troubleshooting

Context

GPS troubleshooting is broken down into two parts: General GPS failure & GPS basic checks. The GPS failure troubleshooting flow can be followed and, where applicable, will feed into the basic checks troubleshooting flow.

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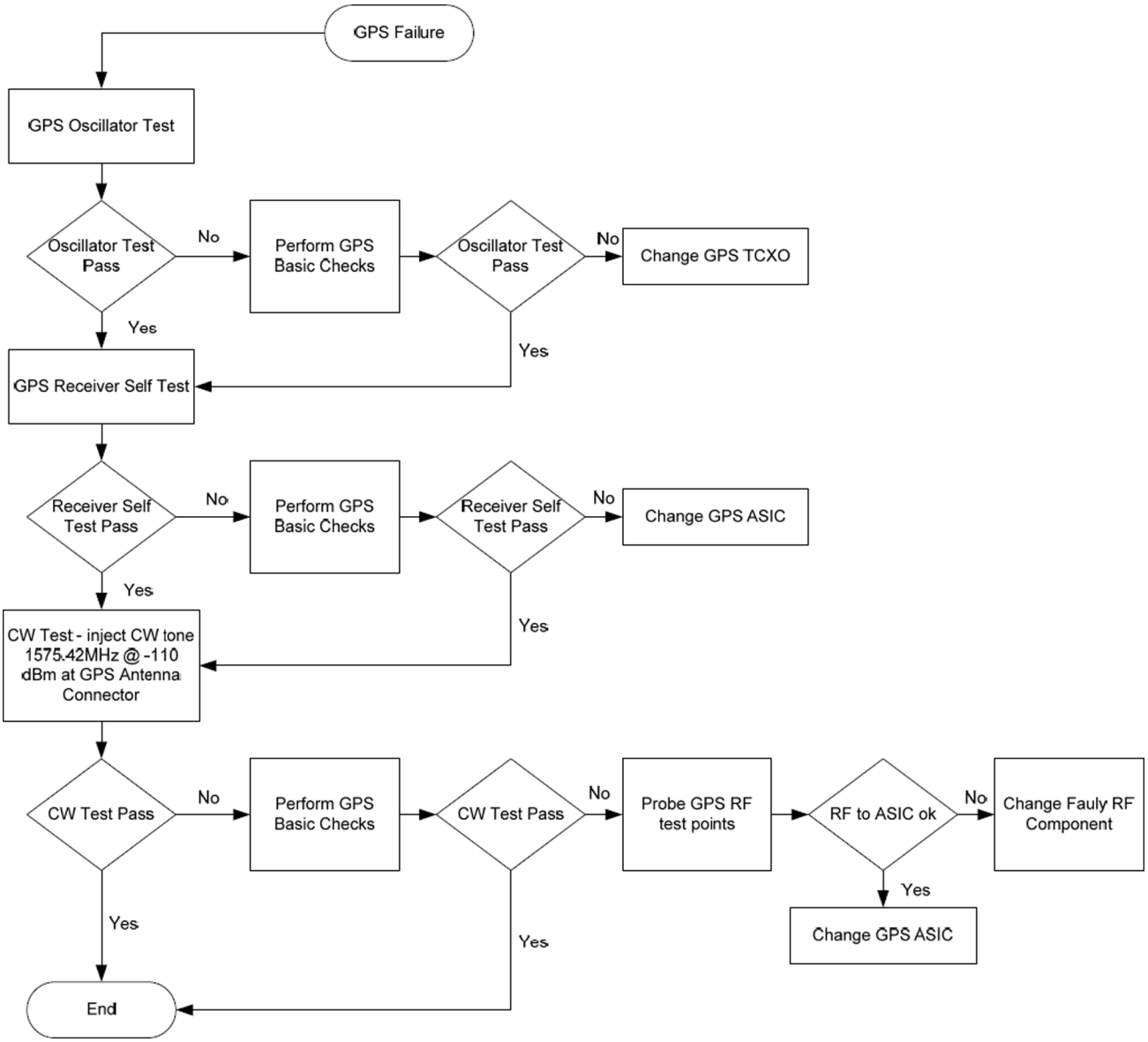
Troubleshooting flow



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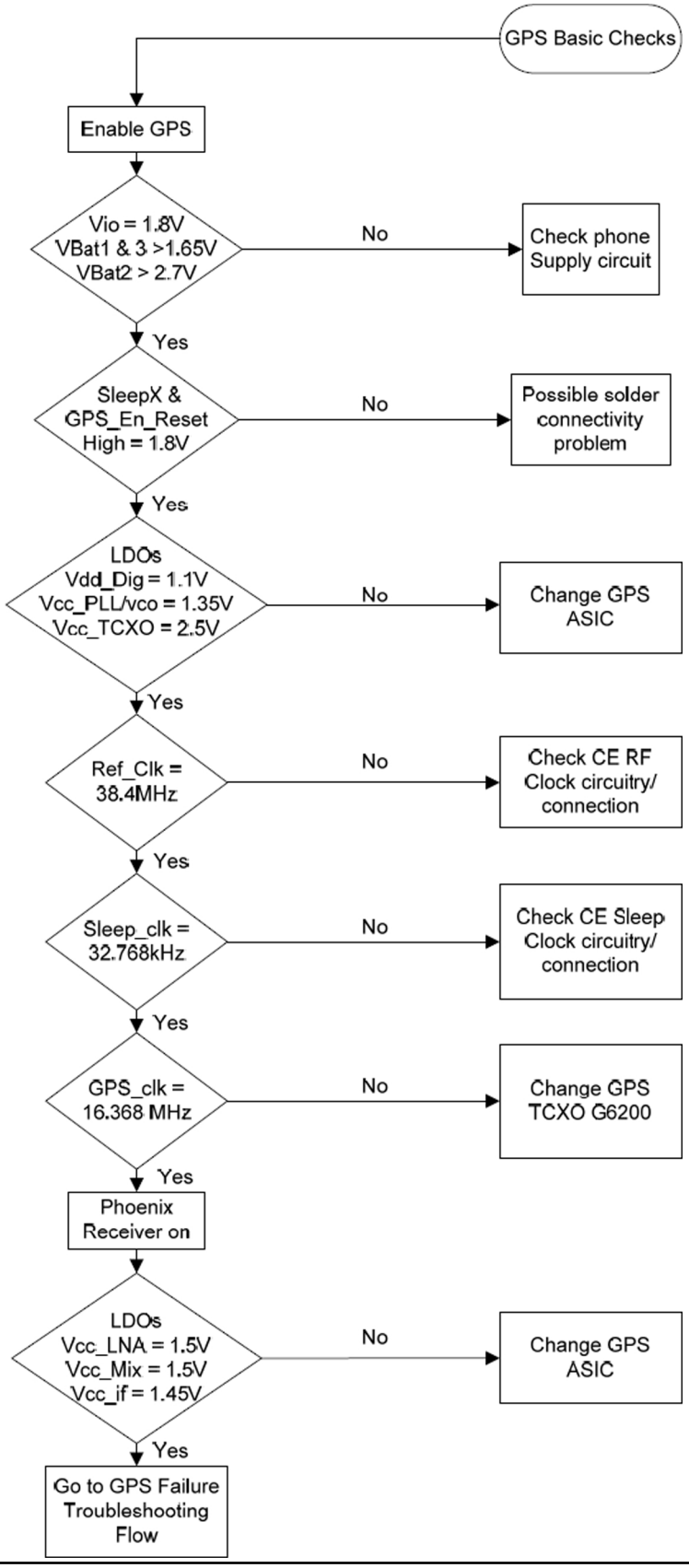
GPS basic checks troubleshooting

Troubleshooting flow



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WLAN troubleshooting

WLAN functional description

The Size 4 WLAN module is designed for use with a single antenna shared between itself and a co-located BT device. The WLAN SW is downloaded from the host engine when the WLAN is turned on over the dedicated SPI interface. BT and WLAN have their own 38,4MHz TCXO.

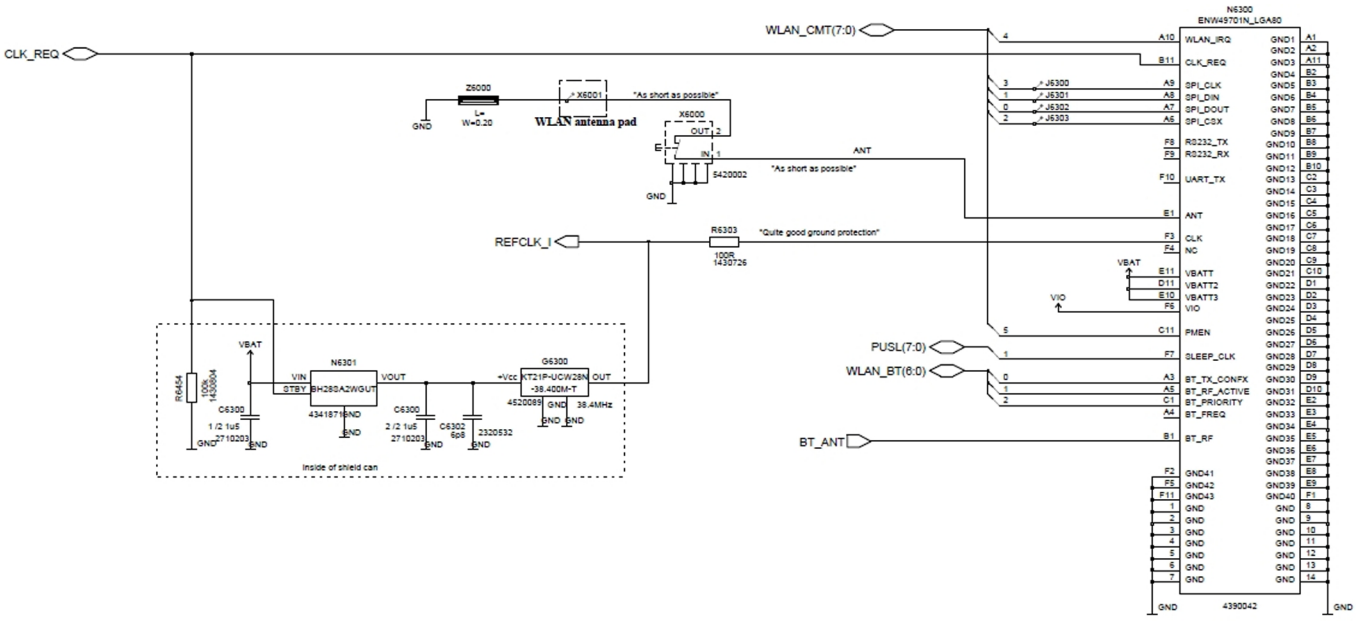

Figure 33 WLAN circuitry

WLAN settings for Phoenix

Use the following to test WLAN using Phoenix:

1 Set phone into Local Mode .

2 From the **File** menu, select **Scan Product** and check that the correct product version is displayed

3 From the **Testing** menu, select **Self Test**. This opens up a Self Test dialogue box, as shown below.

Select the **ST_WLAN_TEST** check box as shown and then select **Start** button. The test turns on the WLAN, sets up the SPI interface and then downloads the WLAN firmware into the WLAN module. During the download the WLAN acknowledges the data blocks and so the self test is a good way to confirm that the WLAN module is communicating with the Host. The result column will change to **Passed** after a few seconds if operating properly.

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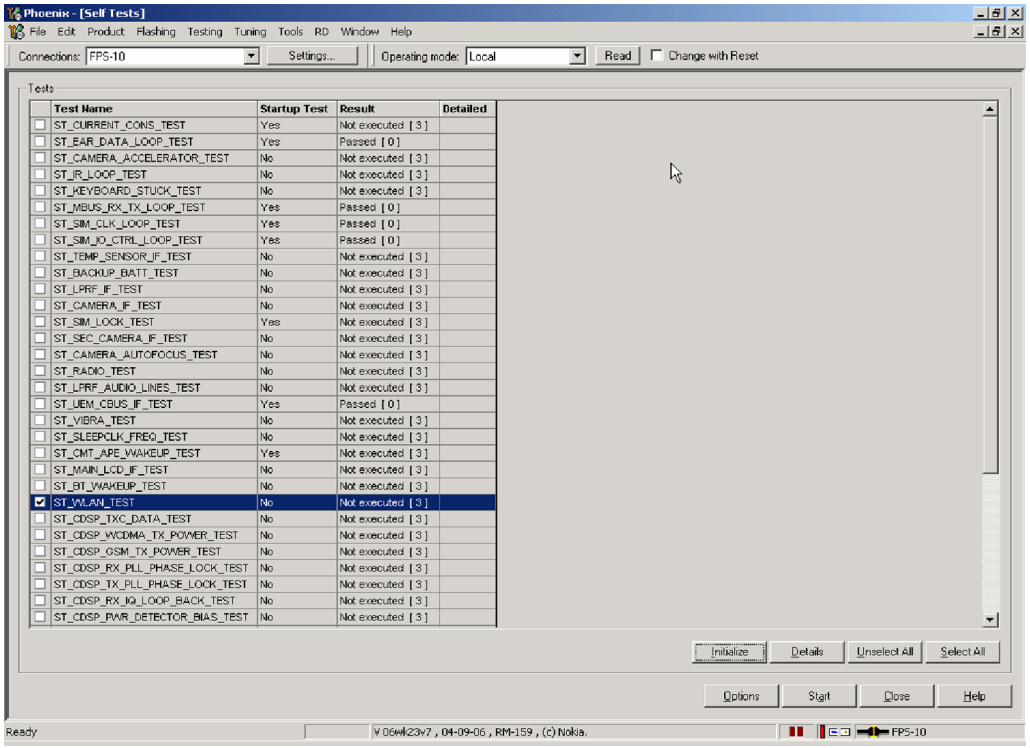
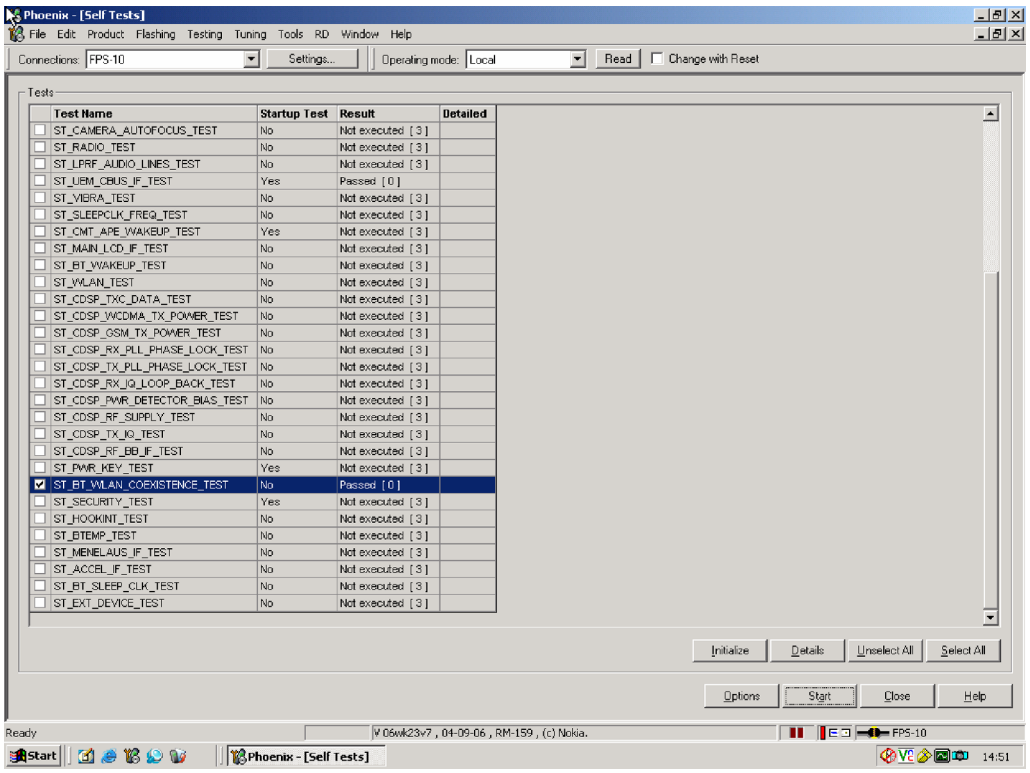


In addition, a test of the WLAN to BTH interface can be done by selecting the **ST_BT_WLAN_COEXISTENCE_TEST** check box and selecting Start button.

This test verifies that the WLAN to BTH co-existence interface signals are properly connected and there are no open circuit or shorts on the four interface signals.

The co-existence interface comprises BTH Txconfig, BTH RF Active, BTH Priority, and BTH Frequency.



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In summary these two Self tests provide a simple means of ensuring the Host engine is able to communicate with the WLAN module and check the interface to BTH. More detailed WLAN performance test is covered in WLAN functional test section.

WLAN functional tests

On/Off test

Prerequisites

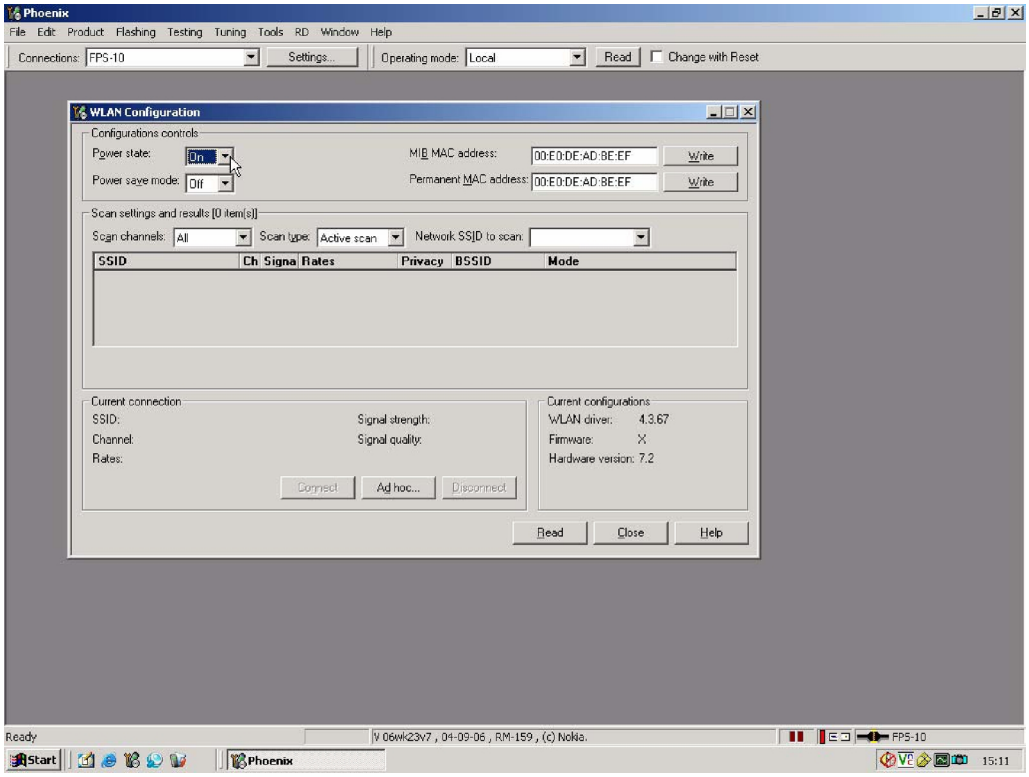
A flash adapter connected to a PC with Phoenix service software is required.

From the testing toolbar select **WLAN Configuration** option. This opens the WLAN configuration dialogue box below. Selecting the Power state option button (as indicated), the WLAN can be turned ON and OFF:

1 With Power State set to OFF, measure the dc power supply current consumption of the flash adaptor.

2 Next return the Power state to ON and re-measure the dc power supply current of the flash adaptor.

The difference between the currents in (1) and (2) should be between 190 to 220mA. When WLAN is ON, the firmware has been downloaded and the WLAN module is in the receive state. When OFF WLAN is powered down.



TX tests

Prerequisites

Connect complete phone assembly with C-cover to a PC with Phoenix service software using a USB data cable.

From the testing toolbar select WLAN Tx Test option shown below. This test can be used to verify TX configuration and functionality. The default settings are sufficient for testing the TX operation, although other channels and data rates are equally suitable. To start the test, select the Start option button:

1 Monitor the WLAN TX spectrum on a Spectrum analyser. (When making a radiated test ensure that other WLAN devices are not transmitting as these may be detected as well, confusing the result). A typical 11MBPS TX spectrum is shown in figure below.

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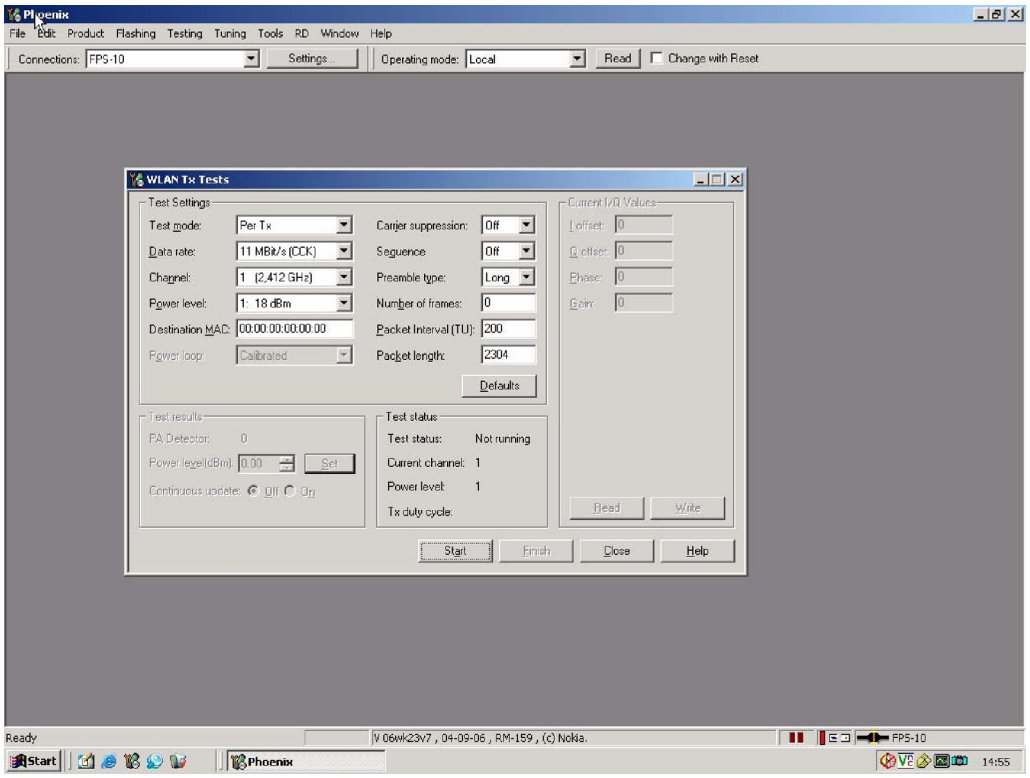
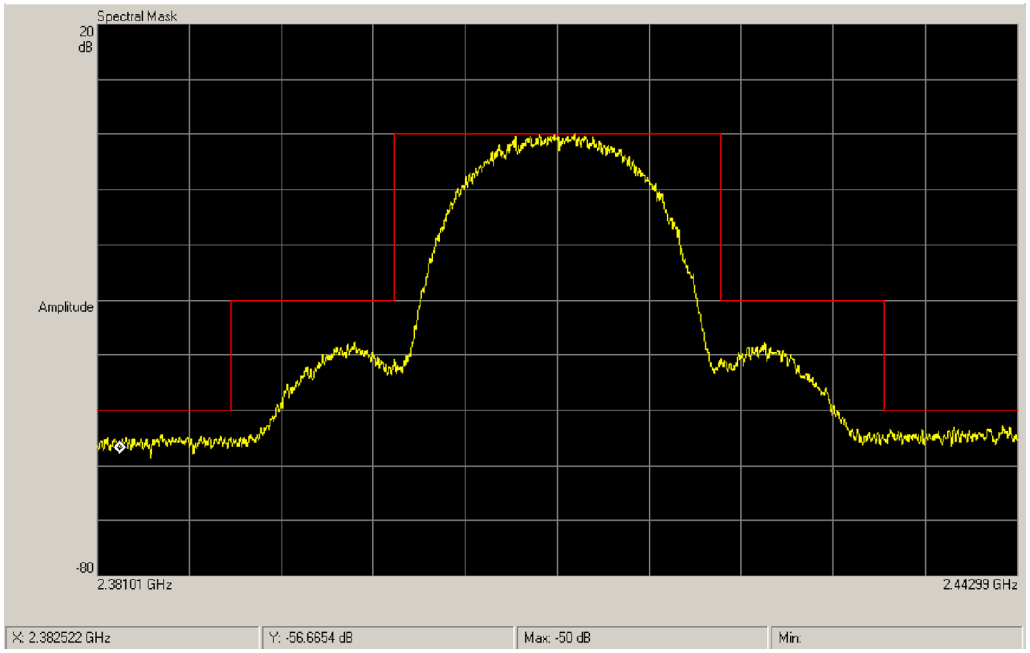
2 To finish the test select the Finish option button.

The difference between the two readings should be approximately 150mA and measures the transmit current in 11MBPS, 802.11b mode of operation.





RX Tests

Prerequisites

Connect complete phone assembly with C-cover to a PC with Phoenix service software using a USB data cable.

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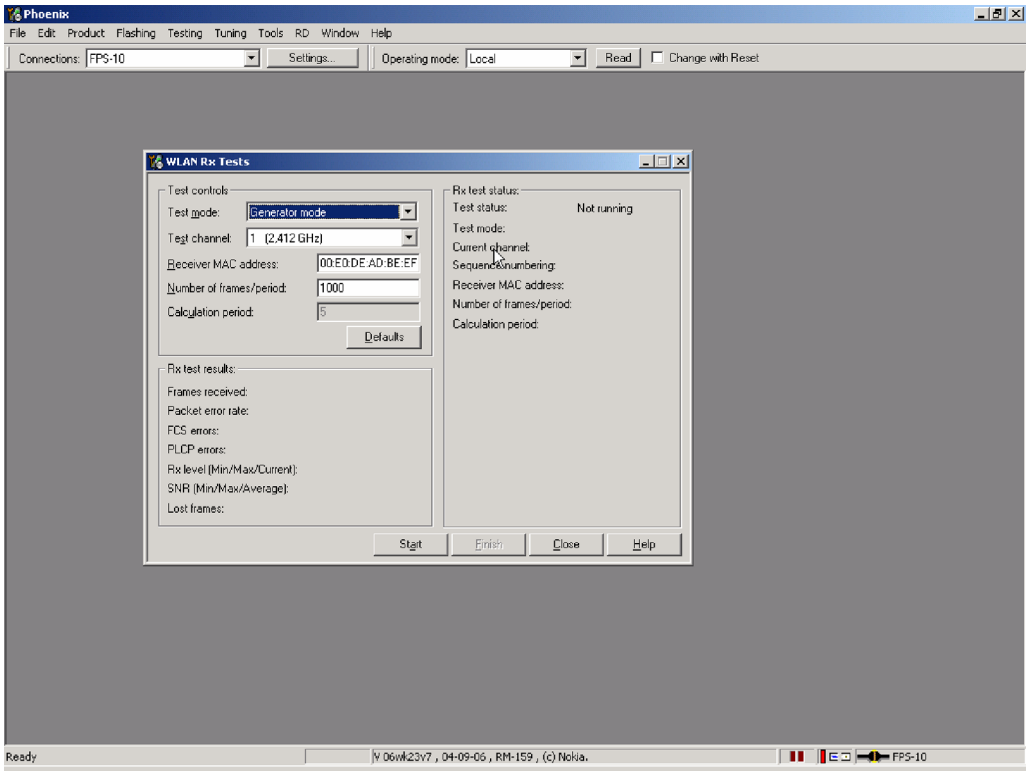
There are different options available for testing the Rx path. The simplest is to use the WLAN to report Rx packets when operating in an area where there is an active WLAN network. Simply starting an Rx test will show the number of packets detected by the WLAN module as it monitors the network. However, it does require a properly configured WLAN network.

From the testing toolbar select WLAN Rx Test option shown below. This test can be used to verify Rx configuration and functionality.

To start the test, select the Start option button.

As the WLAN monitors an active WLAN network, the Rx test results window will update and show the number of Frames received, as well as the Packer error rate.

Monitoring the detected frames is a simple method to verify the WLAN antenna and receiver path is working properly.



WLAN auto tuning

In case of WLAN ASIC change, RF power auto tuning is needed. Connect WLAN RF test connector to CMU200 input using proper RF cable. Start Phoenix WLAN autotune window. Check the settings and verify your PC communicates with CMU200 via GPIB.

Auto tuning procedure

1 Start tuning by pressing **Tune**.

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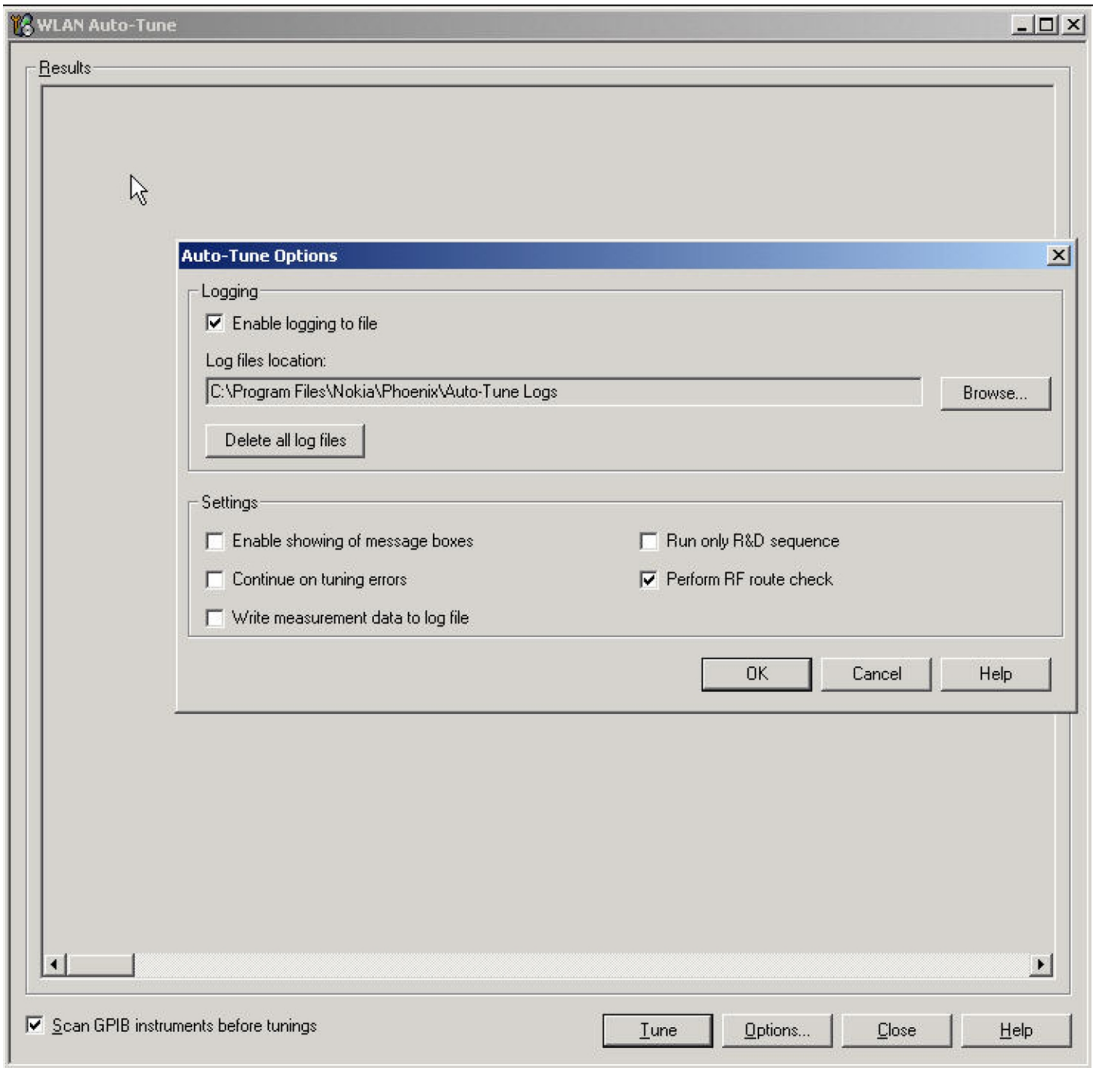

Figure 34 WLAN auto tune settings

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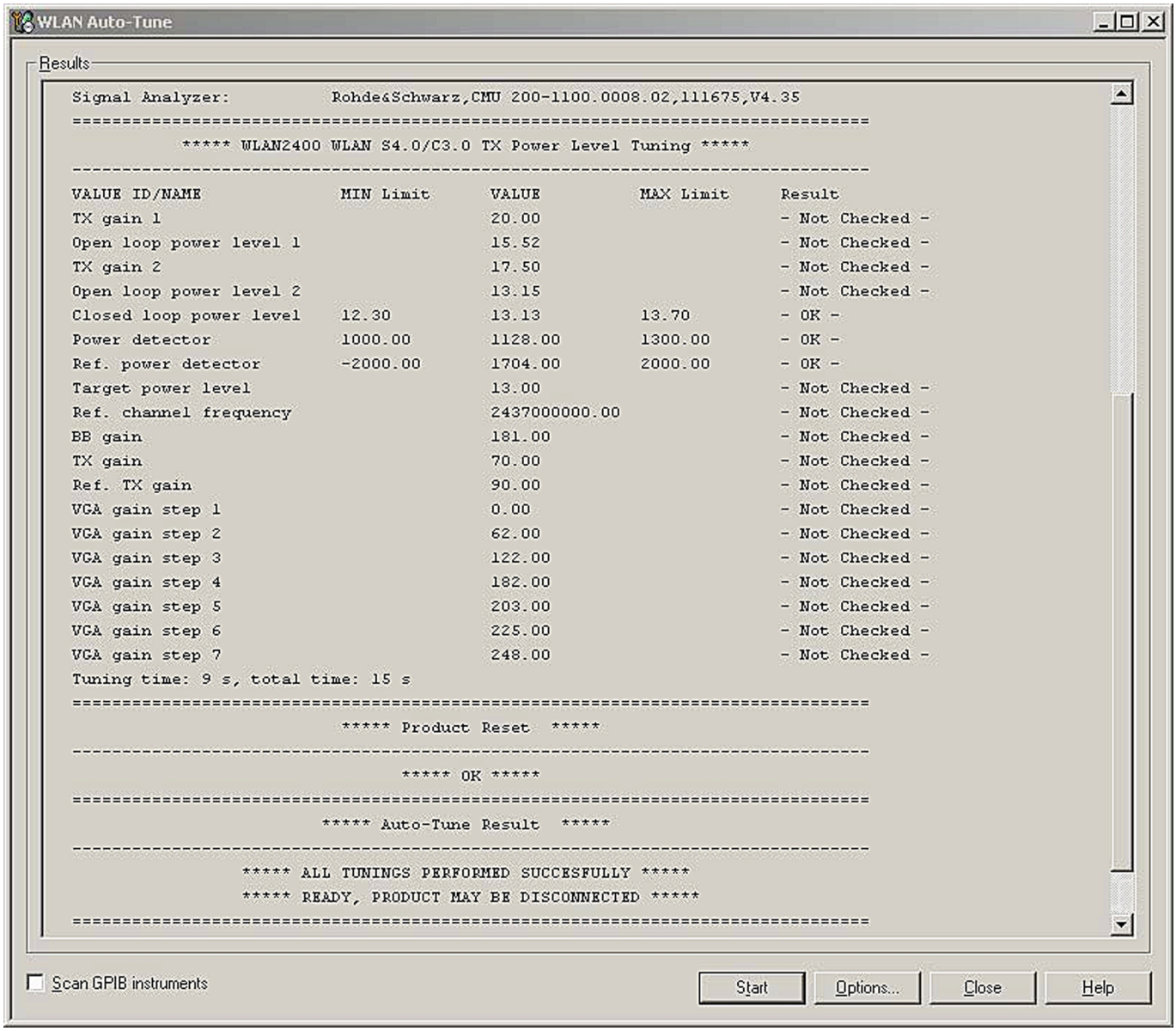

Figure 35 WLAN autotuning results

Bluetooth and FM radio

Bluetooth and FM radio introduction

The Bluetooth and FM radio are combined in the same ASIC, so both features are checked when troubleshooting. The following problems can occur with the Bluetooth and FM radio hardware:

Symptom	Problem	Repair solution
Unable to switch on Bluetooth on phone user interface.	Open circuit solder joints or component failure of BTH/ FM ASIC/module BB ASICs or SMD components.	Replacement of Bluetooth/FM ASIC/ module.

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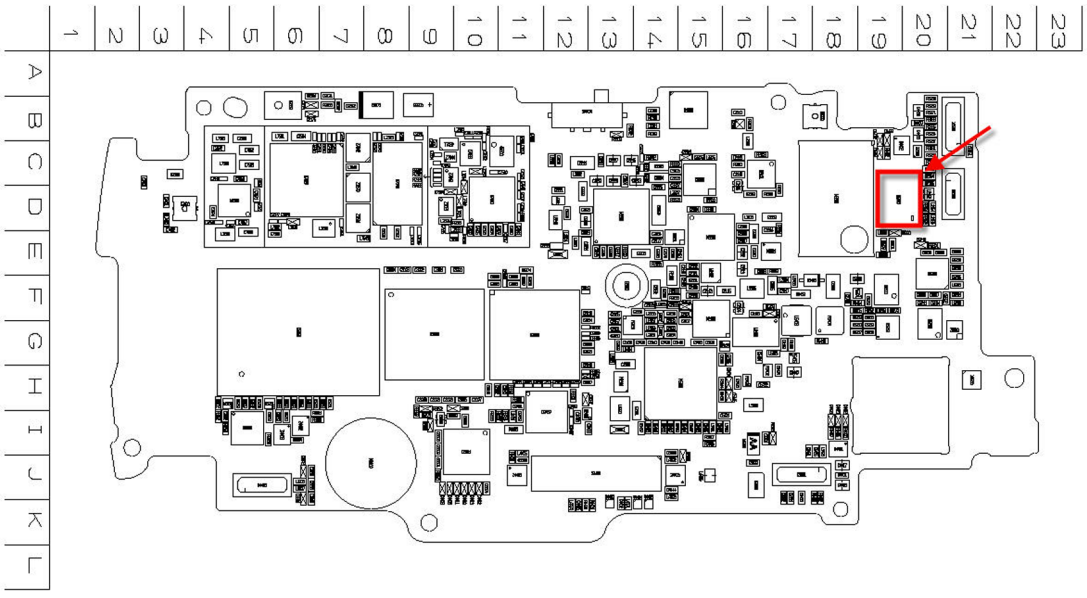
Symptom	Problem	Repair solution
Able to send data file to another Bluetooth device, but unable to hear audio through functional Bluetooth headset.	Open circuit solder joints or component failure of BTH/ FM ASIC/module BB ASICs (PCM interface).	Replacement of Bluetooth/FM ASIC/ module.
Able to turn on Bluetooth on phone user interface, but unable to detect other Bluetooth devices.	Open circuit solder joints or detacted component in Bluetooth antenna circuit.	Repair of Bluetooth antenna circuit.
Able to turn on FM radio and Bluetooth on phone user interface, but unable to detect local FM radio stations with FM headset inserted.	Open circuit solder joints or detached component in FM antenna circuit.	Repair of FM antenna circuit.
Able to perform scans to detect local FM radio stations with functional FM headset inserted, but unable to hear FM audio through headset.	Open circuit solder joints or detached component in FM audio path between Bluetooth/FM ASIC and headset.	Repair of FM audio circuit.

Bluetooth and FM radio component placement

The figure below shows the key component placement for BTHFMRDS2.3M.



2U2_08a_asmdrw_t.pdf

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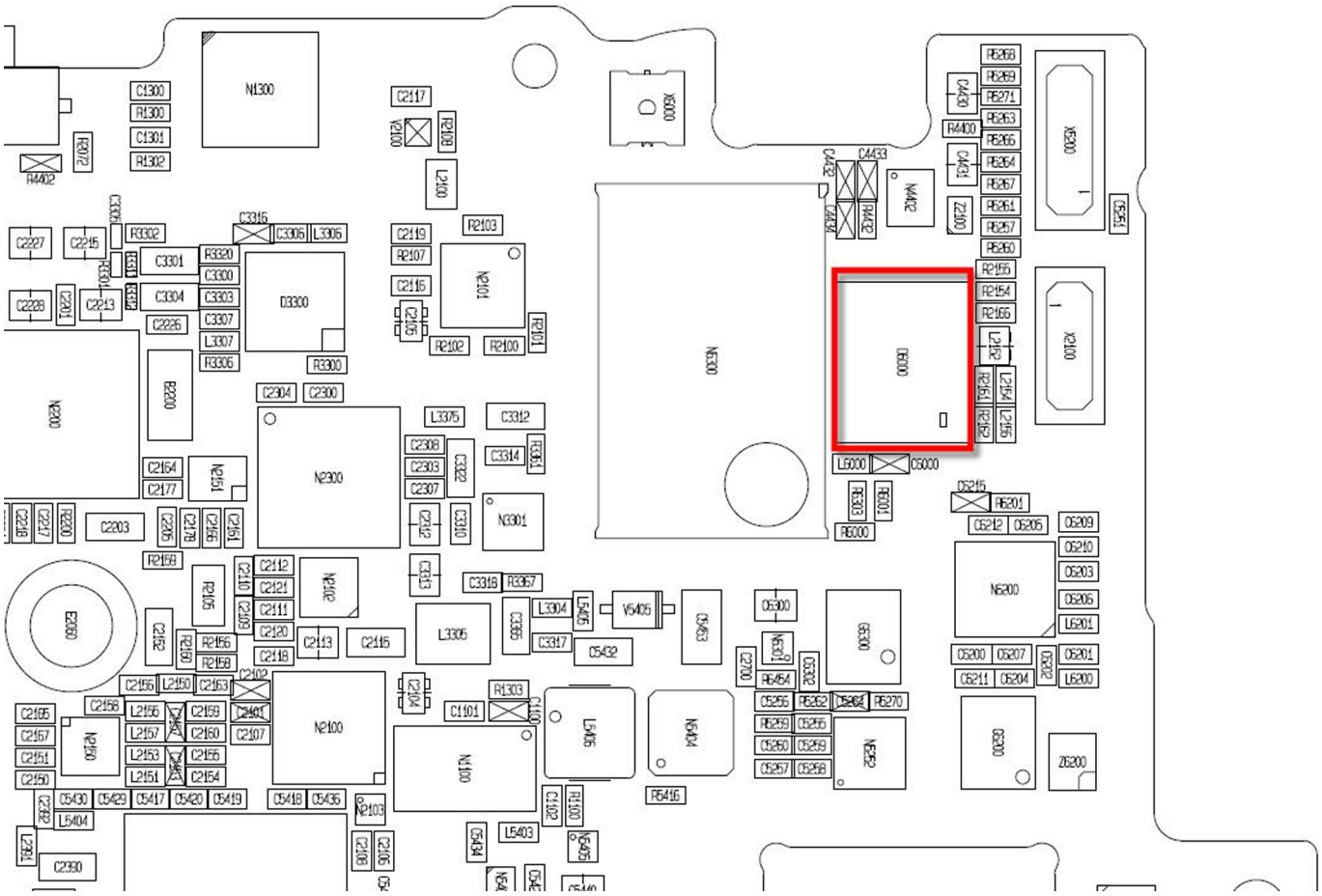

Figure 36 Key component placement for BTHFMRDS2.3M

The shared Bluetooth/WLAN antenna is attached to the side of the B-cover, and the Bluetooth RF signal is routed through a WLAN front-end module.

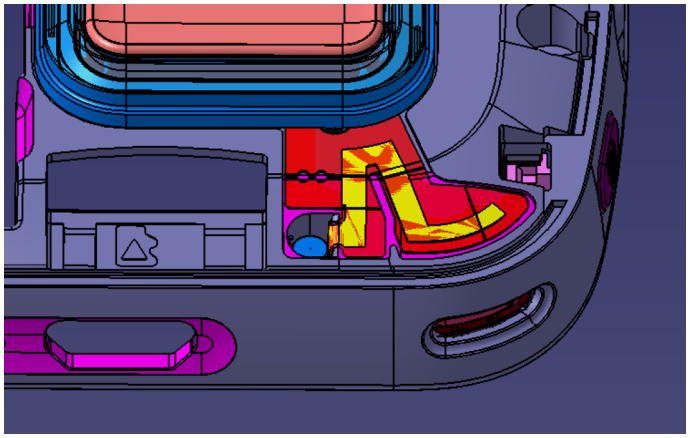

Figure 37 BT/WLAN antenna

The FM radio audio signal is routed to the headset connector through the BB ASIC shared by the phone audio functions.

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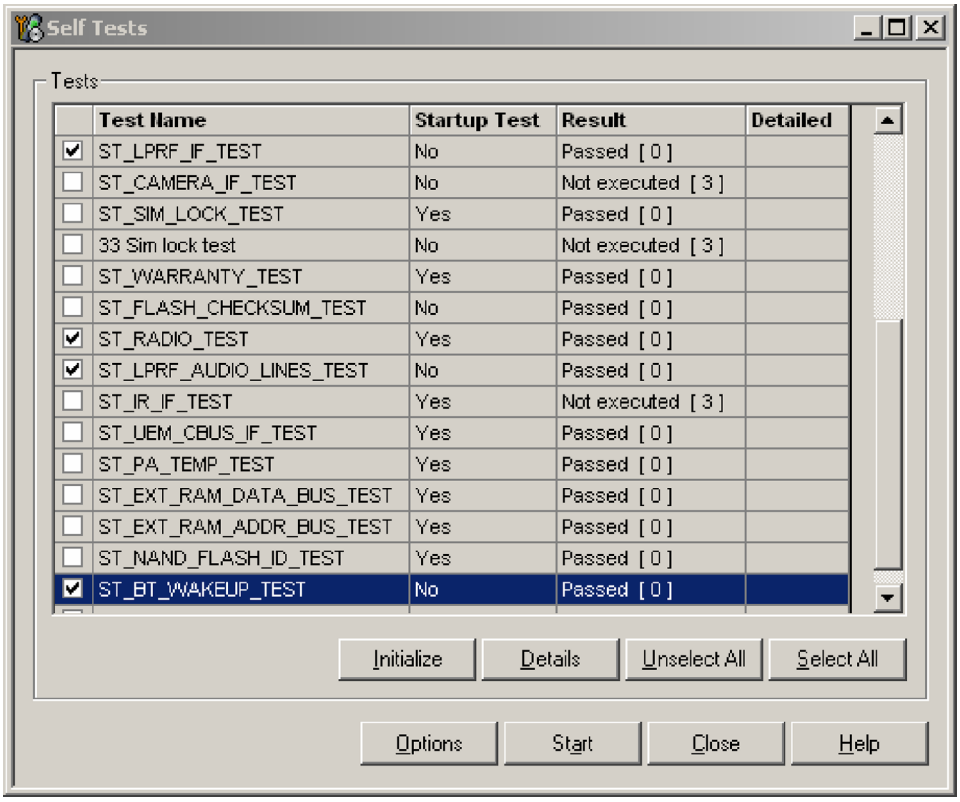
Bluetooth and FM Radio Self Tests

Context

A flash adapter (or phone data cable) connected to a PC with Phoenix service software is required.

Steps

1. Place the phone in the flash adapter.
2. Start Phoenix service software.
3. Choose File → Scan Product.
4. From the Mode drop-down menu, set to Local.
5. Choose Testing → Self Tests.
6. In the Self Tests window check the following Bluetooth and FM Radio tests:
   - ST_LPRF_IF_TEST
   - ST_LPRF_AUDIO_LINES_TEST
   - ST_BT_WAKEUP_TEST
   - ST_RADIO_TEST
7. To run the test, click Start



Bluetooth BER test

Context

JBT-9 or SB-6 Bluetooth test box (BT box) is required to perform a BER test. If a BT box is not available, Bluetooth functionality can be checked by transferring a file to another Bluetooth phone.

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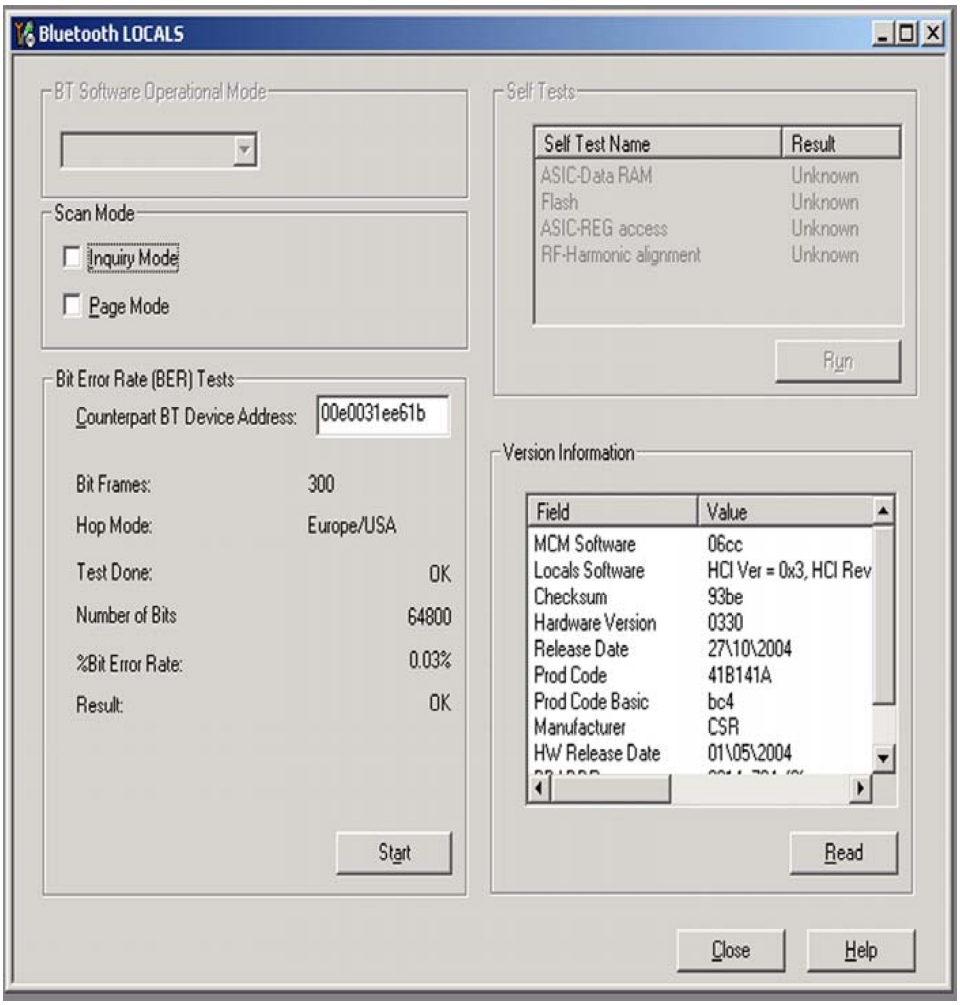
Steps

1. Place the phone in the flash adapter.
2. Start Phoenix service software.
3. Choose **File → Scan Product**.
4. Choose **Testing → Bluetooth LOCALS**
5. Locate the BT-box serial number (12 digits) found in the type label on the back of the JBT-3, JBT-6, JBT-9, or SB-6 Bluetooth test box.
6. In the Bluetooth LOCALS window, write the 12-digit serial number on the **Counterpart BT Device Address** line.
7. Place the BT-box near (within 10 cm) of the phone and click **Run BER Test**.



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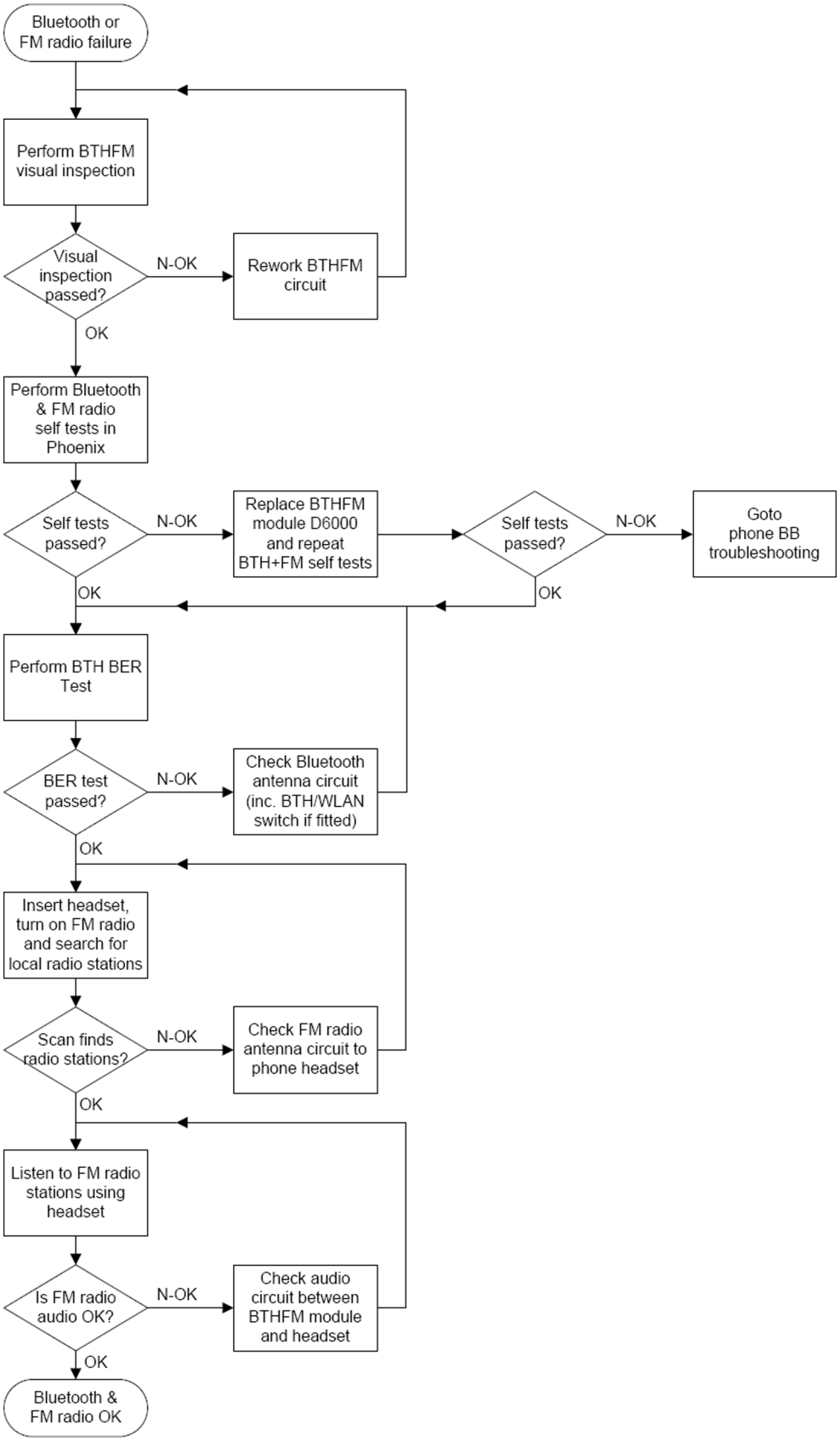
Bluetooth and FM radio module troubleshooting

Troubleshooting flow



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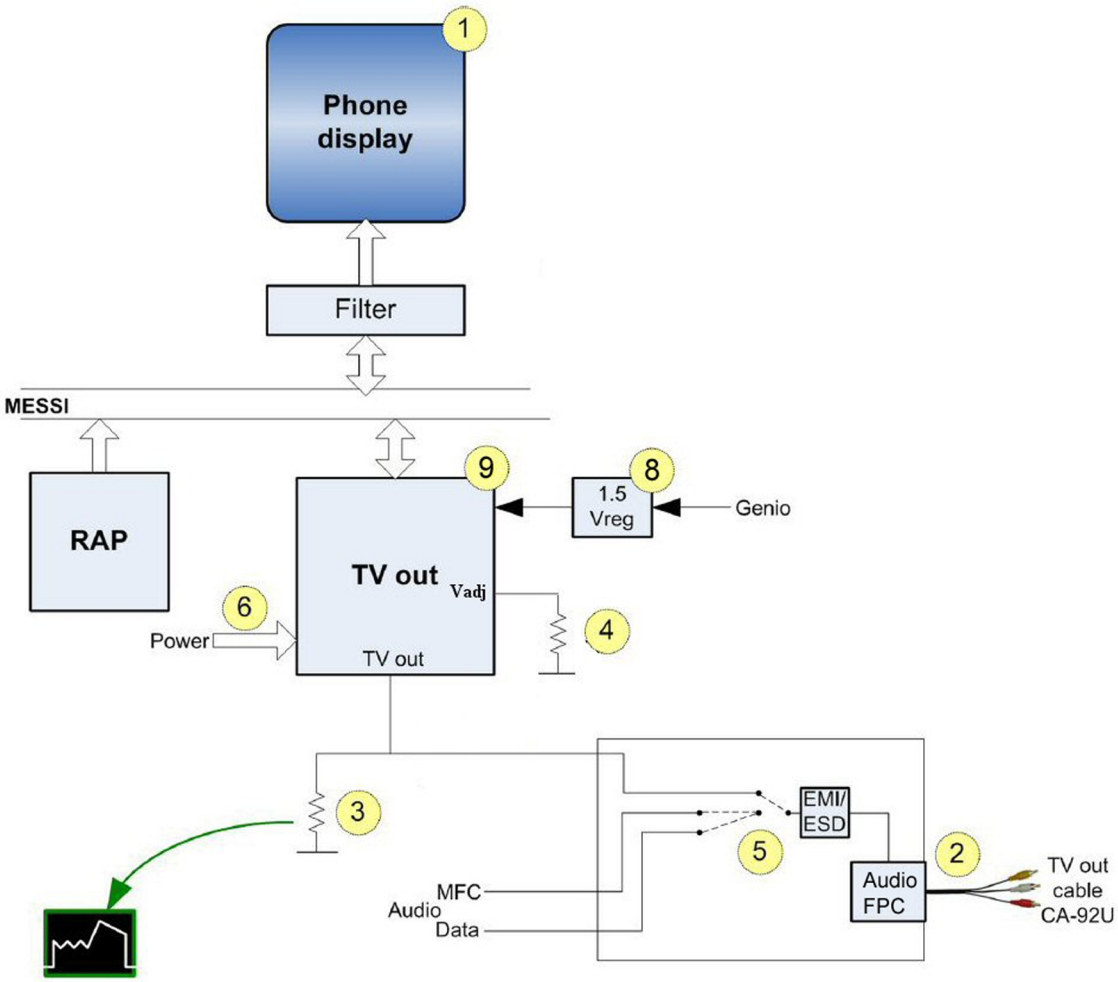
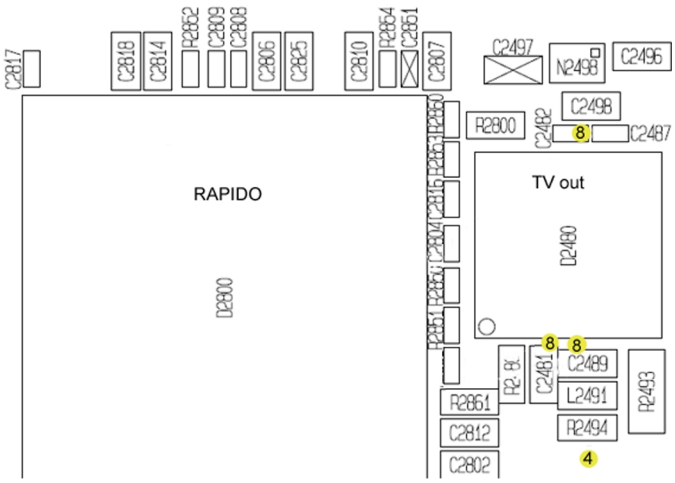
TV out troubleshooting

Troubleshooting flow



TV out testpads



Troubleshooting steps

1) Make sure that the phone display is working
2) Make sure that the TV out cable is plugged into both phone and TV set. If no image is shown on TV, make sure it is selected in phone SW; *Settings > Enhancements > TV cable > Activate TV out (activate appropriate TV standard)*
3) Check TV out signal **(R2493)**
4) Check **R2494.** Also check **R2480.**
5) Check switch EMI/EDS + AV connector (**C2166, N2151, L2154)**
6) Check if connector X2100 (on main PWB) is properly connected to X400 (audio flex)
7) Check X401 on audio flex
8) Verify voltage on these capacitors:
C2482 (IO) = 1.72 V - 1.92 V
C2481 (Core) = 1.44 V - 1.56 V
C2489 (VDAC) = 2.66 V - 2.86 V
9) Replace TV out ASIC (**D2480**)
10) Retest after each repair/replaced part

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Audio troubleshooting

Audio troubleshooting test instructions

Single-ended external earpiece and differential internal earpiece outputs can be measured either with a single-ended or a differential probe.

When measuring with a single-ended probe each output is measured against the ground.

Internal handsfree output is measured using a current probe, if a special low-pass filter designed for measuring a digital amplifier is not available. Note also that when using a current probe, the input signal frequency must be set to 2kHz.

The input signal for each loop test can be either single-ended or differential. Exception to this is a digital microphone, which needs input signal from an external sound source (laptop speaker) to playback eg. 1kHz sine wave from 5cm distance.

Required equipment

The following equipment is needed for the tests:

- Oscilloscope
- Function generator (sine waveform)
- Current probe (Internal handsfree PWM output measurement)
- Phoenix service software
- Battery voltage 3.7V
- Sound source (laptop speaker or B&K type 4231 calibrator)

Test procedure

Audio can be tested using the Phoenix audio routings option. Three different audio loop paths can be activated:

- AV microphone to AV earpiece
- AV microphone to HP earpiece
- External microphone in Internal handsfree out
- HP microphone to AV earpiece

Each audio loop sets routing from the specified input to the specified output enabling a quick in-out test. Loop path gains are fixed and they cannot be changed using Phoenix. Correct pins and signals for each test are presented in the following table.

Phoenix audio loop tests and test results

The results presented in the table apply when no accessory is connected and battery voltage is set to 3.7V.

Earpiece, internal microphone and speaker are in place during measurement. Applying a headset accessory during measurement causes a significant drop in measured quantities.

The gain values presented in the table apply for a differential output vs. single-ended/differential input.

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Loop test	Input terminal	Output terminal	Path gain [dB] (fixed)	Input voltage [mVp-p]	Output voltage [mVp-p]	Output DC level [V]	Output current [mA]
AV Mic to AV Earpiece	HS_MIC & GND	HS_EAR_L & GND		100		1.2	NA
		HS_EAR_R & GND					
AV Mic to HP Earpiece	HS_MIC & GND	EarP & GND		100		1.2	NA
		EarN & GND					
HP Mic to AV Earpiece	Acoustical input, 1kHz sine wave	HS_EAR_L & GND	NA	94 dB SPL	100		NA
		HS_EAR_R & GND					
External Mic in Internal handsfree out	HS_MIC & GND	B2153		1000			
		B400					

Measurement data

Earpiece signal

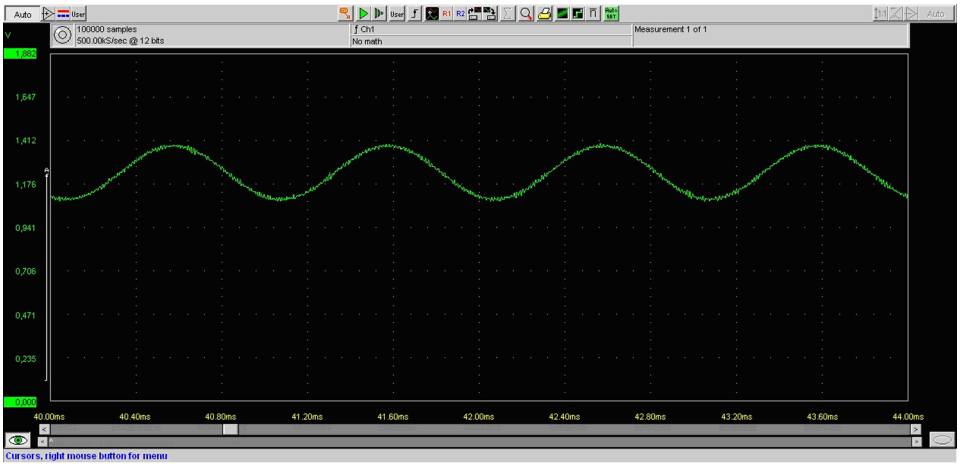

Figure 38 Single-ended output waveform of the AV Mic to HP Ear measurement when earpiece is connected.

Integrated handsfree signal

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Figure 39 Single-ended output waveform of the Ext_microphone in Int handsfree out loop measurement when speaker is connected (measured at speaker pads). No filter is used.

External output from AV

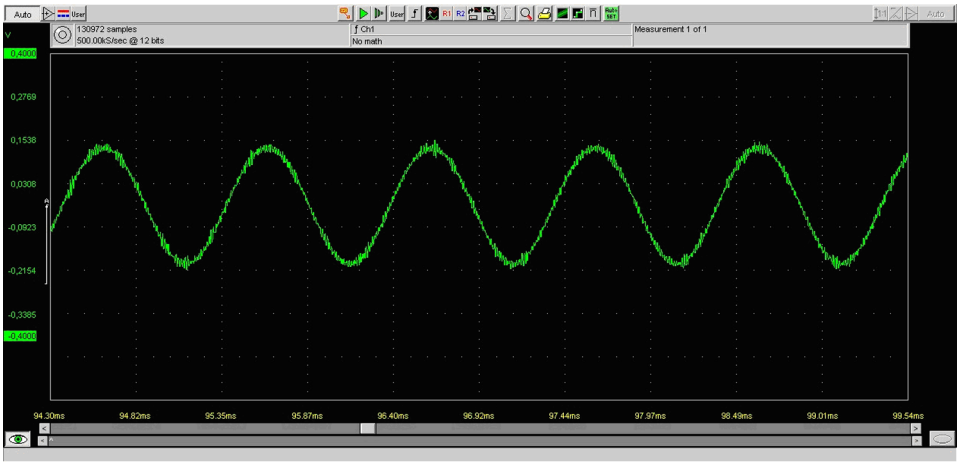

Figure 40 Single-ended output waveform of the AV Mic to AV Ear loop.

External output from AV (acoustic input)

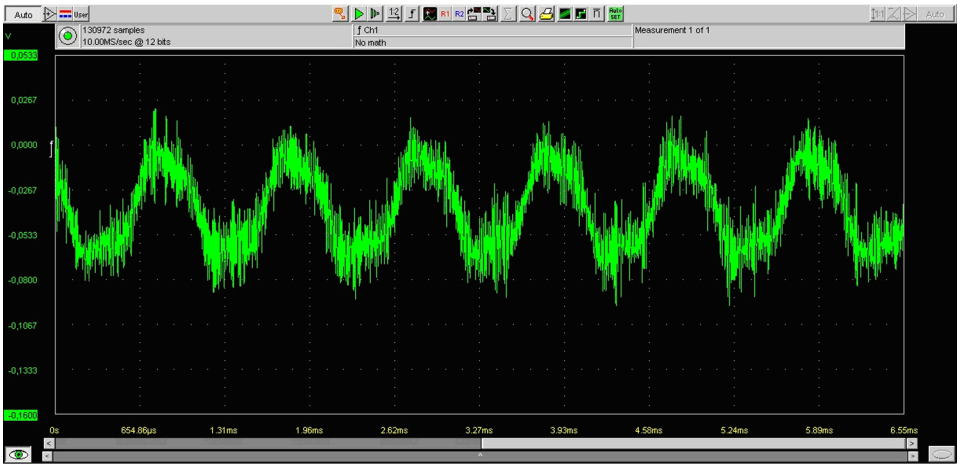

Figure 41 Single-ended output waveform of the HP Mic to AV Ear loop.

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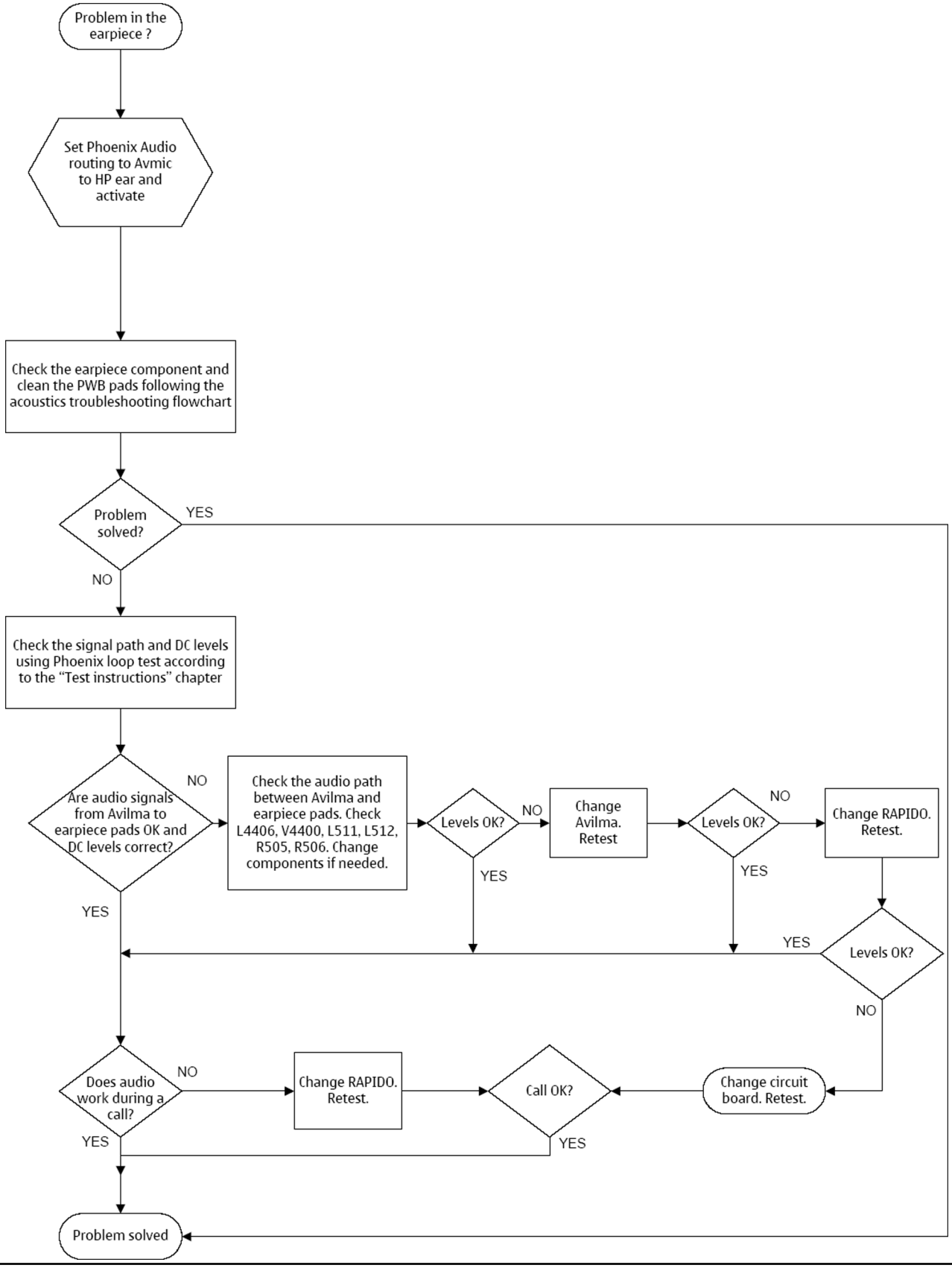
Internal earpiece troubleshooting

Troubleshooting flow



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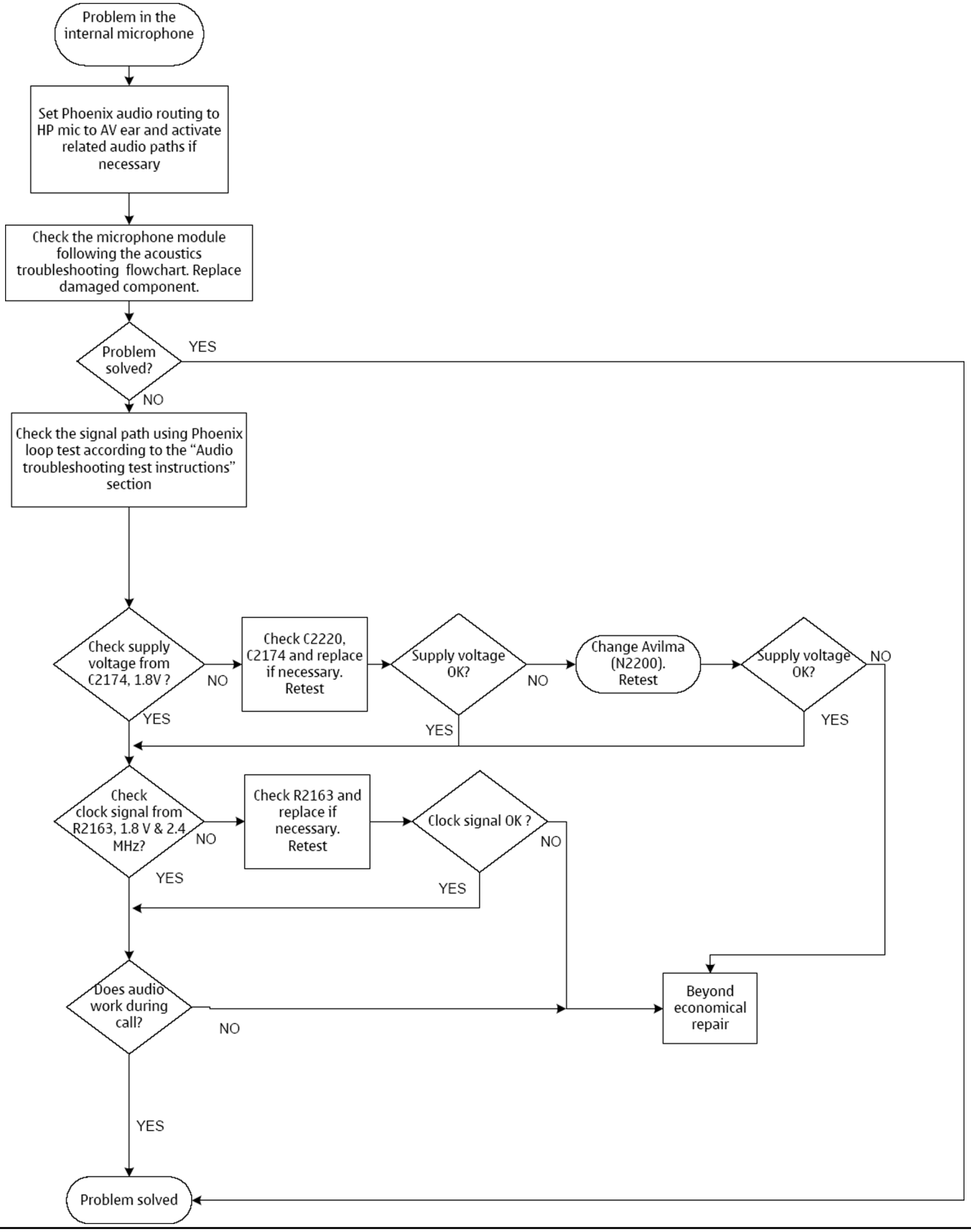
Internal microphone troubleshooting

Troubleshooting flow



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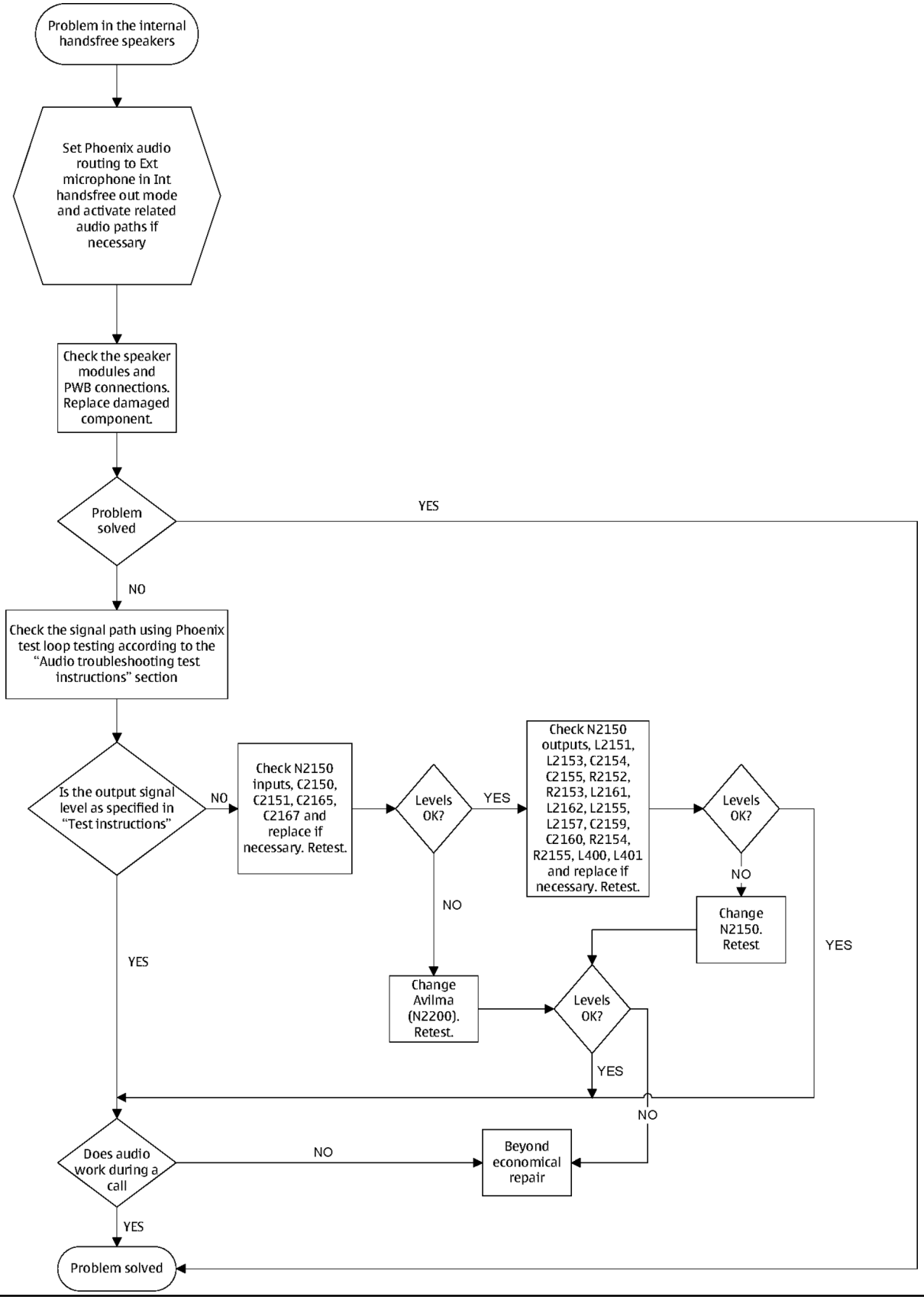
Internal handsfree speaker troubleshooting

Troubleshooting flow



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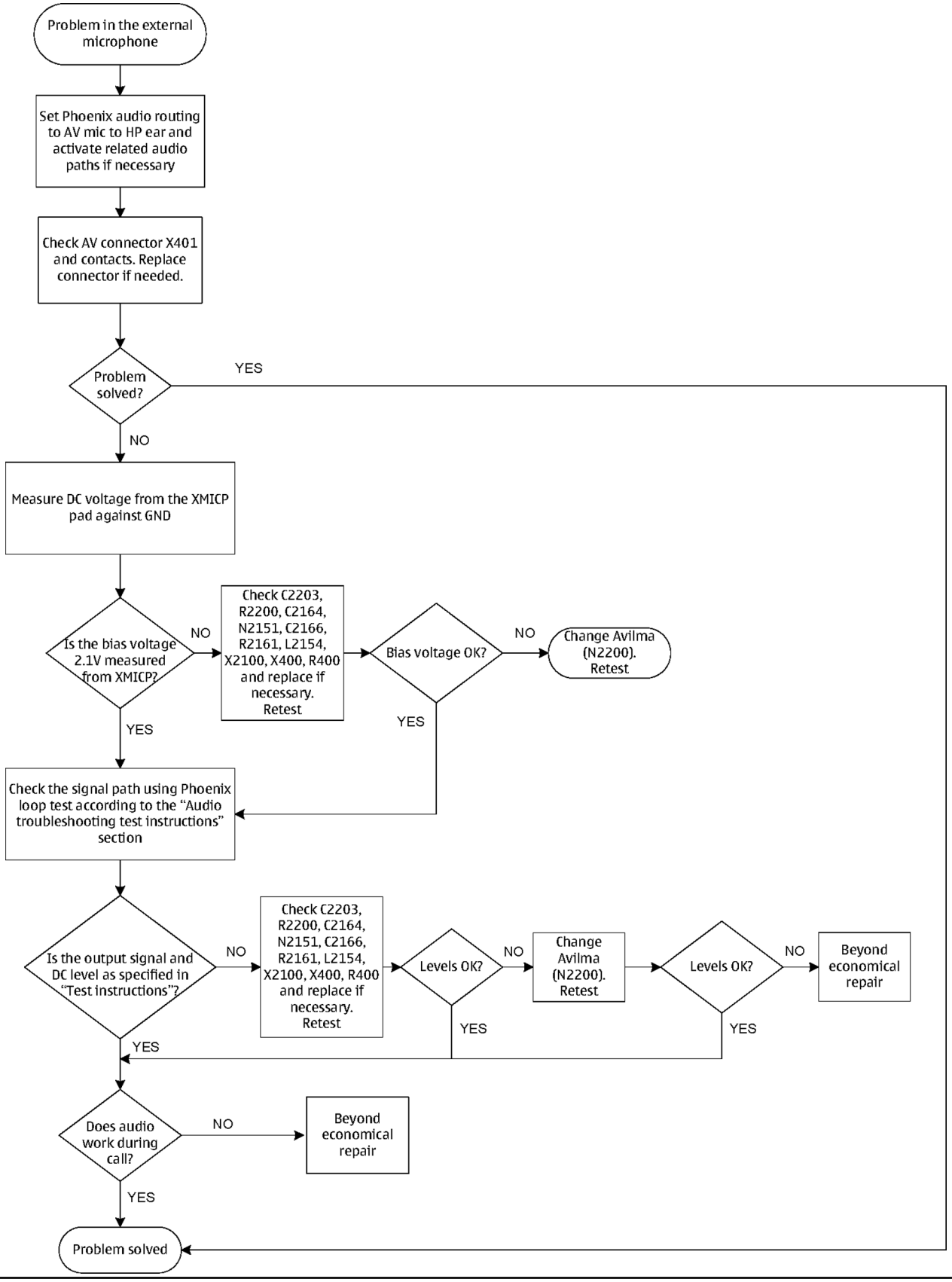
External microphone troubleshooting

Troubleshooting flow



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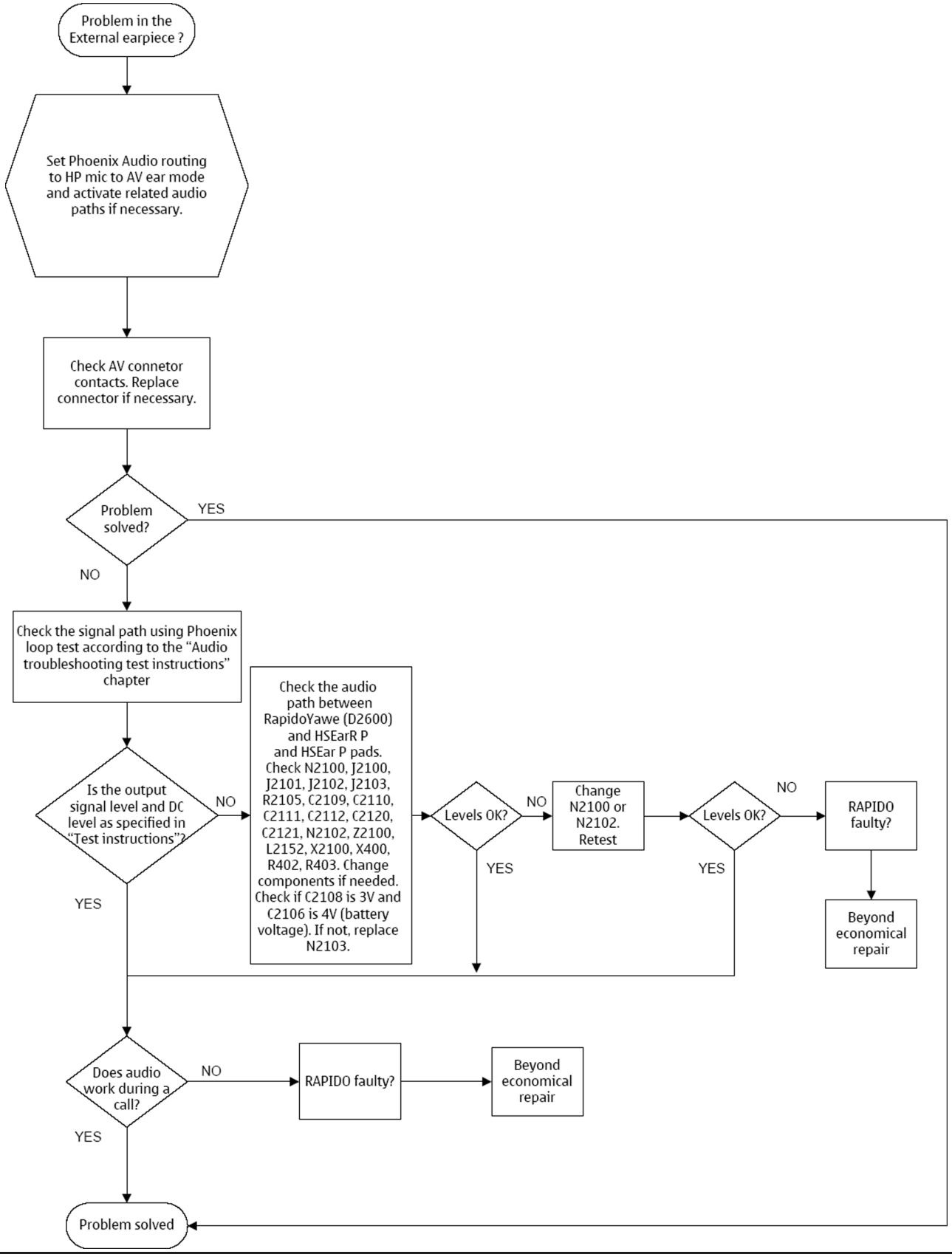
External headset earpiece troubleshooting

Troubleshooting flow



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Acoustics troubleshooting

Introduction to acoustics troubleshooting

Acoustics design ensures that the sound is detected correctly with a microphone and properly radiated to the outside of the device by the speaker. The acoustics of the phone includes three basic systems: earpiece, Integrated Hands Free (IHF) and microphone.

The sound reproduced from the earpiece radiates through a single hole on the front cover (A-cover). The sound reproduced from the IHF speakers radiate through dual sound holes located at the top and bottom of the phone. The microphone is located around the 'space' key in the keymat of the phone.

For a correct functionality of the phone, all sound holes must be always open. When the phone is used, care must be taken not to close any of those holes with a hand or fingers. The phone should be dry and clean, and no objects must be located in such a way that they close any of the holes.

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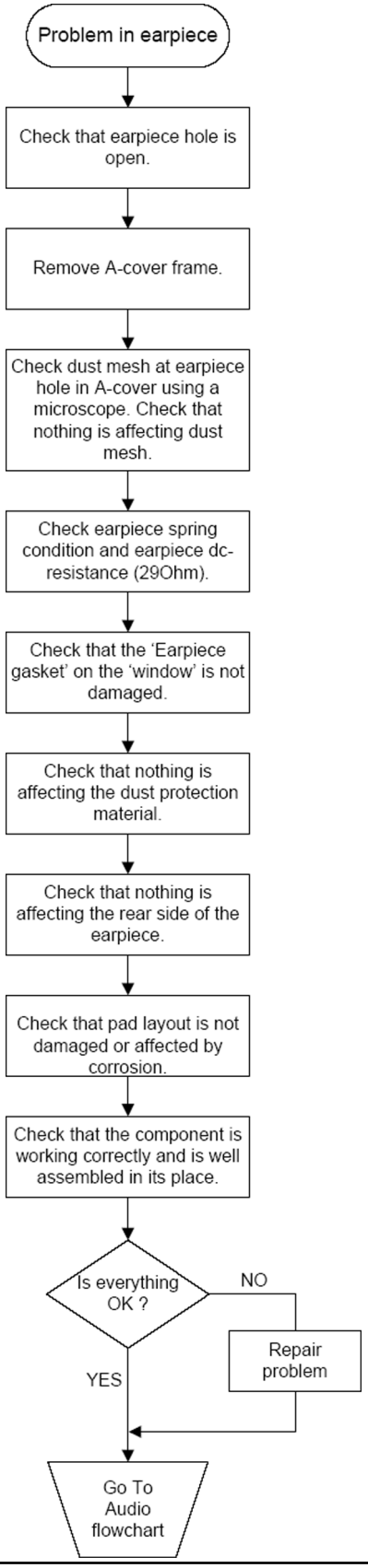
Earpiece troubleshooting

Troubleshooting flow



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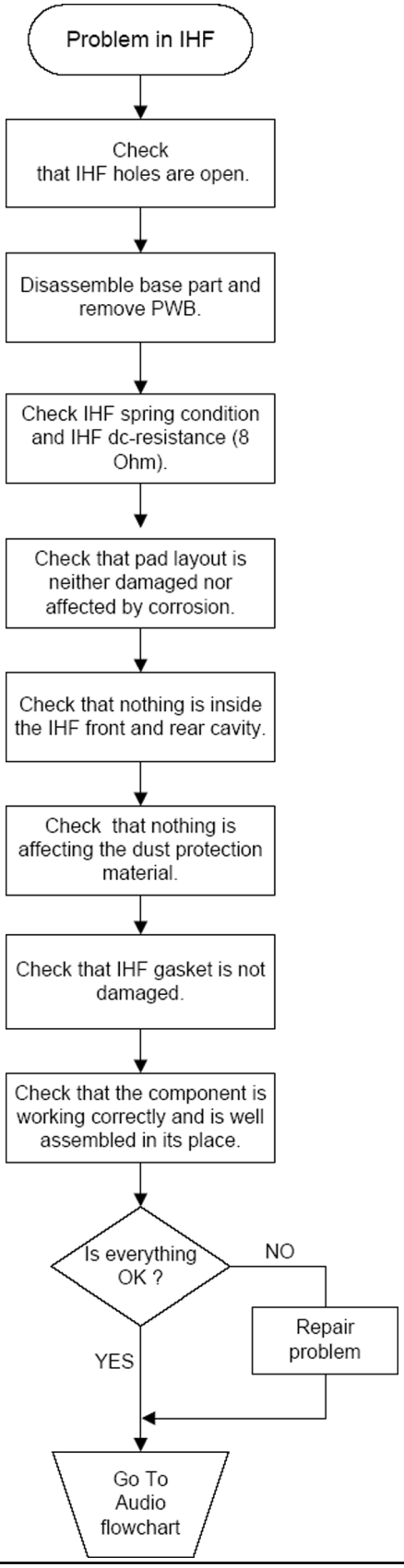
IHF troubleshooting

Troubleshooting flow



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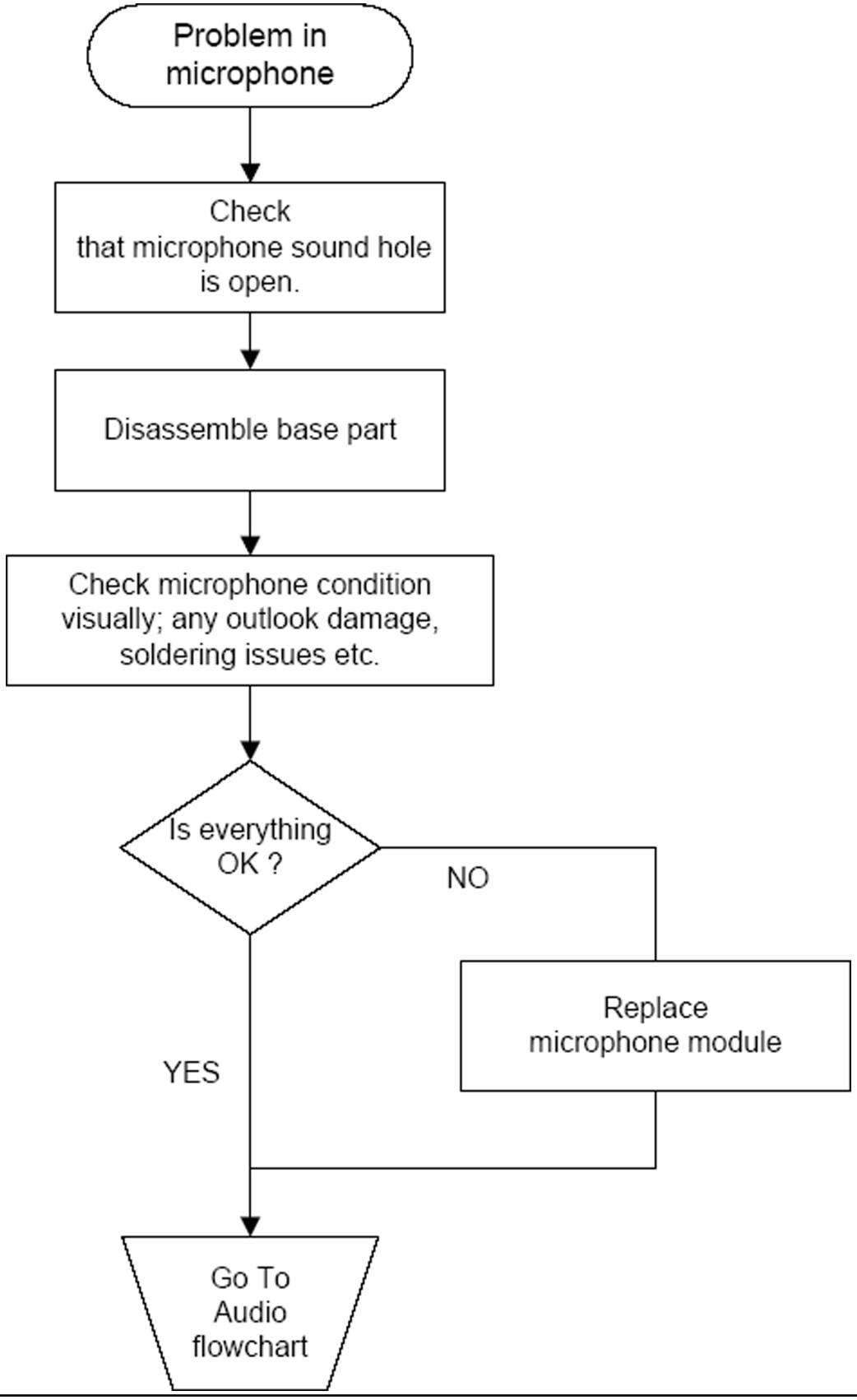
Microphone troubleshooting

Troubleshooting flow



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Baseband manual tuning guide

Certificate restoring

Context

This procedure is performed when the device certificate is corrupted for some reason.

All tunings (RF & Baseband, UI) must be done after performing the certificate restoring procedure.

The procedure for certificate restoring is the following:

- Flash the phone with the latest available software using FPS-10 or FPS-21.

  Note: If the COMBO memory of a phone is replaced, the ENO SW must be flashed first before performing the "normal" firmware flashing.
- Execute the certificate restore process in Phoenix.
- Tune the phone completely.

  Note: SX-4 smart card is needed.
- If the phone resets after certificate restoring, reflash the phone again.

Required equipment and setup:

- *Phoenix* service software v 2008.34.6 or newer.
- The latest phone model specific *Phoenix* data package.
- PKD-1 dongle
- SX-4 smart card (Enables testing and tuning features)
- External smart card reader
- Activated FPS-10 **OR** FPS-21 flash prommer
- Latest flash update package for FPS-10 or FPS-21 flash prommers
- CU-4 control unit
- USB cable from PC USB Port to CU-4 control unit
- Phone model specific adapter for CU-4 control unit
- PCS-1 cable to power CU-4 from external power supply
- XCS-4 modular cable between flash prommer and CU-4

  Note: CU-4 must be supplied with +12 V from an external power supply in all steps of certificate restoring.

Steps

1. Program the phone software.

   Note: If the COMBO memory of a phone is replaced, the ENO SW must be flashed first before performing the "normal" firmware flashing.
2. Execute the certificate restore process in Phoenix.

Next actions

After a successful rewrite, you must retune the phone completely by using *Phoenix* tuning functions.

Important: Perform all tunings: RF, BB, and UI.

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Energy management calibration

Prerequisites

Energy Management (EM) calibration is performed to calibrate the setting (gain and offset) of AD converters in several channels (that is, **battery voltage**, **BSI**, **battery current**) to get an accurate AD conversion result.

Hardware setup:

- An external power supply is needed.
- Supply 12V DC from an external power supply to CU-4 to power up the phone.
- The phone must be connected to a CU-4 control unit with a product-specific flash adapter.

Steps

1. Place the phone to the docking station adapter (CU-4 is connected to the adapter).
2. Start *Phoenix* service software.
3. Choose **File→ Scan Product.**
4. Choose **Tuning→Energy Management Calibration.**
5. To show the current values in the phone memory, click **Read**, and check that communication between the phone and CU-4 works.
6. Check that the **CU-4 used** check box is checked.
7. Select the item(s) to be calibrated.

   Note: ADC calibration has to be performed before other item(s). However, if all calibrations are selected at the same time, there is no need to perform the ADC calibration first.
8. Click **Calibrate**.

   The calibration of the selected item(s) is carried out automatically.

   The candidates for the new calibration values are shown in the *Calculated values* column. If the new calibration values seem to be acceptable (please refer to the following "Calibration value limits" table), click **Write** to store the new calibration values to the phone permanent memory.

Table 9 Calibration value limits

Parameter	Min.	Max.
ADC Offset	-20	20
ADC Gain	12000	14000
BSI Gain	1100	1300
VBAT Offset	2400	2650
VBAT Gain	19000	23000
VCHAR Gain	N/A	N/A
IBAT (ICal) Gain	7750	12250

9. Click **Read**, and confirm that the new calibration values are stored in the phone memory correctly. If the values are not stored to the phone memory, click **Write** and/or repeat the procedure again.
10. To end the procedure, close the *Energy Management Calibration* window.

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4 — RF Troubleshooting

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General RF troubleshooting

Introduction to RF troubleshooting

Most RF semiconductors are static discharge sensitive

ESD protection must be applied during repair (ground straps and ESD soldering irons).

Measuring equipment

All measurements should be done using:

- An oscilloscope for low frequency and DC measurements. Recommended probe: 10:1, 10Mohm//8pF.
- A radio communication tester including RF generator and spectrum analyser, for example Rohde & Schwarz CMU200. (Alternatively a spectrum analyser and an RF generator can be used. Some tests in this guide are not possible to perform if this solution is chosen).

  Note: A mobile phone WCDMA transmitter should never be tested with full TX power (it is only possible to perform the measurements in a good RF-shielded room). Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.

  Note: All communication Test Set Screen dumps are from CMU200. Other testers are different.

  Note: All measurements with an RF coupler should be performed in an RF-shielded environment because nearby base stations can disturb sensitive receiver measurements. If there is no possibility to use RF shielded environment, testing at frequencies of nearby base stations should be avoided.

Level of repair

The scope of this guideline is to verify functionality of the cellular RF block without removing RF shield.

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RF key components

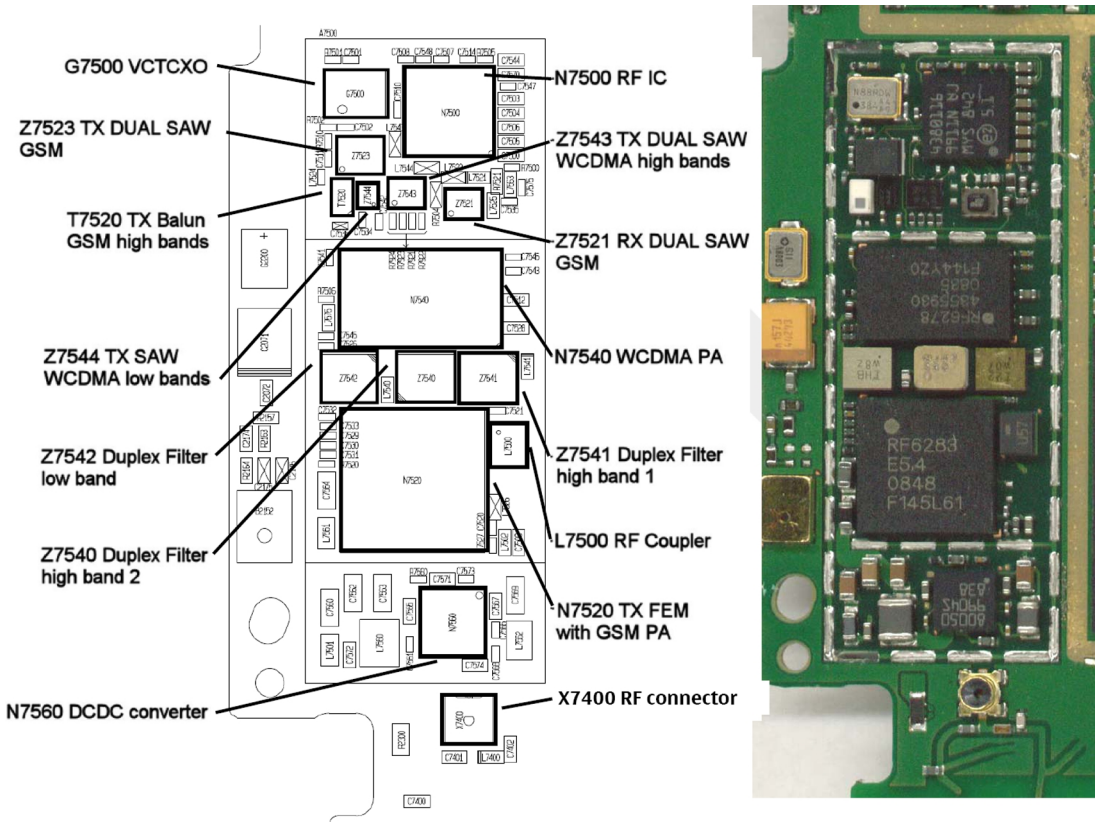

Figure 42 RF key components

Auto tuning

Introduction to RF tunings

RF tuning is always performed with the help of a product-specific module jig, never with an RF coupler. Using an RF coupler in the tuning phase will cause a complete mistuning of the RF part.

Cable and adapter losses

RF cables and adapters have some losses. They have to be taken into account when the phone is tuned. As all RF losses are frequency dependent, the user has to act very carefully and understand the measurement setup. For RF attenuations of the module jig and RF cable, please refer to the Service Tools section.

Auto tuning

This phone can be tuned automatically.

Auto tuning is designed to align the phone's RF part easier and faster. It performs calibrations, tunings and measurements of RX and TX. The results are displayed and logged in a result file, if initiated.

Hardware set up

For hardware requirements for auto tuning, please refer to Service concept for RF testing and RF/BB tuning (page 4–21).

Phoenix preparations

Install the phone specific data package, for example *_dp_1.78_sw_sh3.26.exe*. This defines phone specific settings.

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Auto tuning procedure

1 Make sure the phone (in the jig) is connected to the equipment. Otherwise some menus will not be shown in Phoenix.

2 To go to autotune, select **Tuning (Alt-U)→Auto-Tune (Alt-A)** from the menu.

3 Start autotuning by clicking the *Tune* button.

Self Test Troubleshooting

Troubleshooting with RF Self tests

Context

Vapaus (N7500) RF ASIC contains test structures that can be used to detect certain RF related errors. In order to use these self tests most efficient way, it is very important that the tests are performed in a certain order, or at least that the error data is analyzed in this order. The tests are designed so that by going through them in this order it is easy to find the problem component without any redundant checks. The flowchart presented in this document is based on that idea. So, if RFBUS fails , there is no need to spend time wondering why there is no power at TX, etc.

The testing order recommended and used in this troubleshooting guide is the following:

1 ST_CDSP_RF_BB_IF test (86)
- Tests the functionality of the BB/Vapaus serial interface & Reset lines.
- If this test fails, it means that there is a problem in programming of the N7500 and all of the following tests can not give correct data.

2 ST_CDSP_RF_SUPPLY_TEST (83)
- Tests the functionality of N7500 bias block, regulators, reference voltage line and, supply connections.
- If these fail, all other N7500 tests can/will fail.

3 ST_CDSP_TX_IQ_TEST (85)
- Test checks that the TXIQ lines between BB and N7500 are properly connected.
- If this fails also power tests and RXIQ loopback will fail.

4 ST_CDSP_TXC_DATA_TEST (74)
- This tests that the TXC line between AVILMAS (N2200) & Vapaus (N7500) is properly connected.
- If this fails TX power tests will also fail.

5 ST_CDSP_RX_PLL_PHASE_LOCK_TEST (79)
- Tests the functionality of RX PLL.
- If this fails none of the RX related measurements can be trusted.

6 ST_CDSP_TX_PLL_PHASE_LOCK_TEST (80)
- Tests the functionality of TX PLL.
- If this fails the TX power tests will also fail.

7 ST_CDSP_TX_WCDMA_POWER_TEST (75)
- Checks the output power of the WCDMA transmitter.

8 ST_CDSP_RX_IQ_LOOPBACK (81)
- Tests that the RXI lines and VREFCM line between BB and N7500 are connected.

9 ST_CDSP_TX_GSM_POWER_TEST (77)
- Checks the output power of the GSM transmitter.

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To get the best out of these instructions you need to be have the valid schematics at hand, see Chapter 10 in this document.

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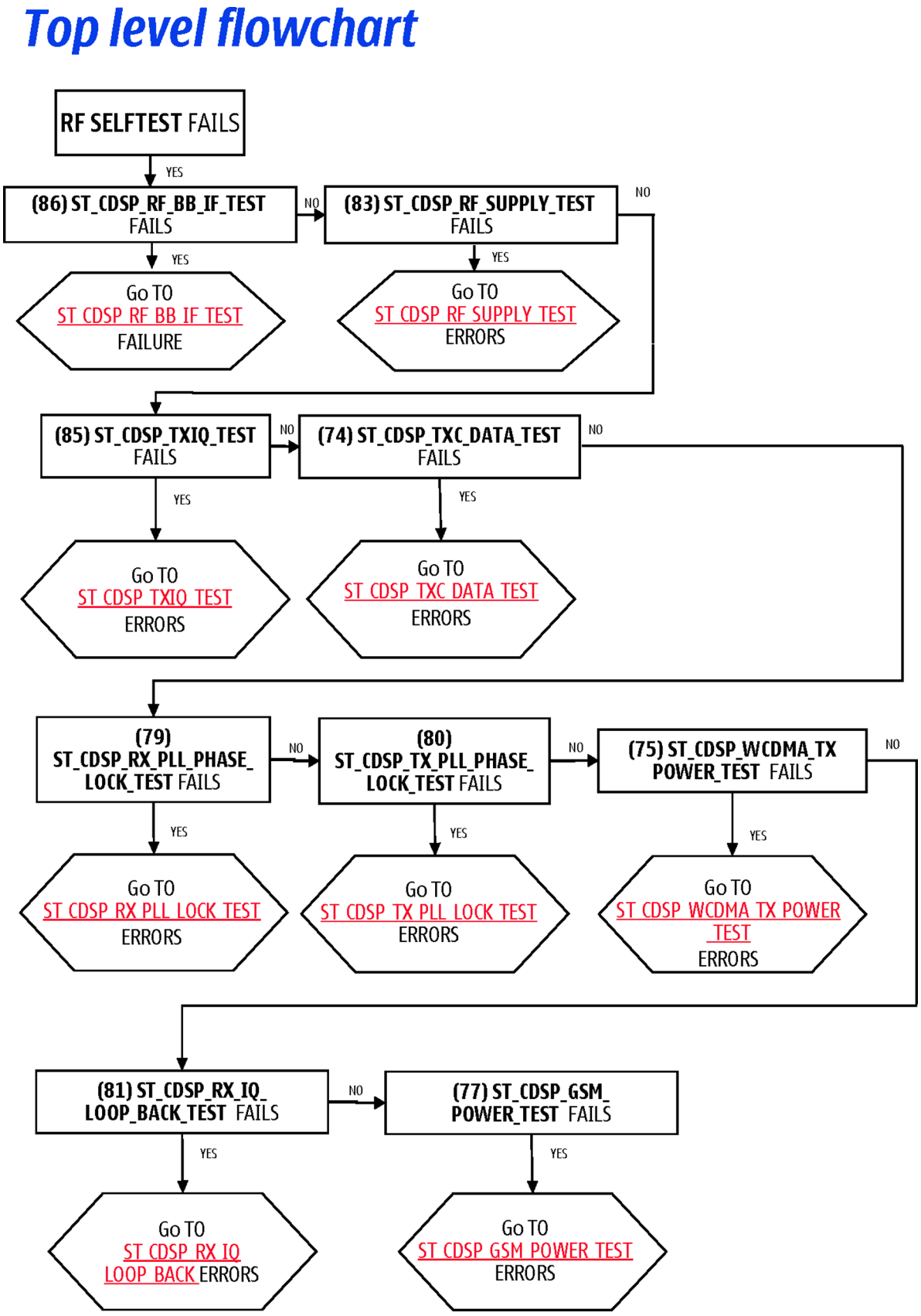
Troubleshooting flow



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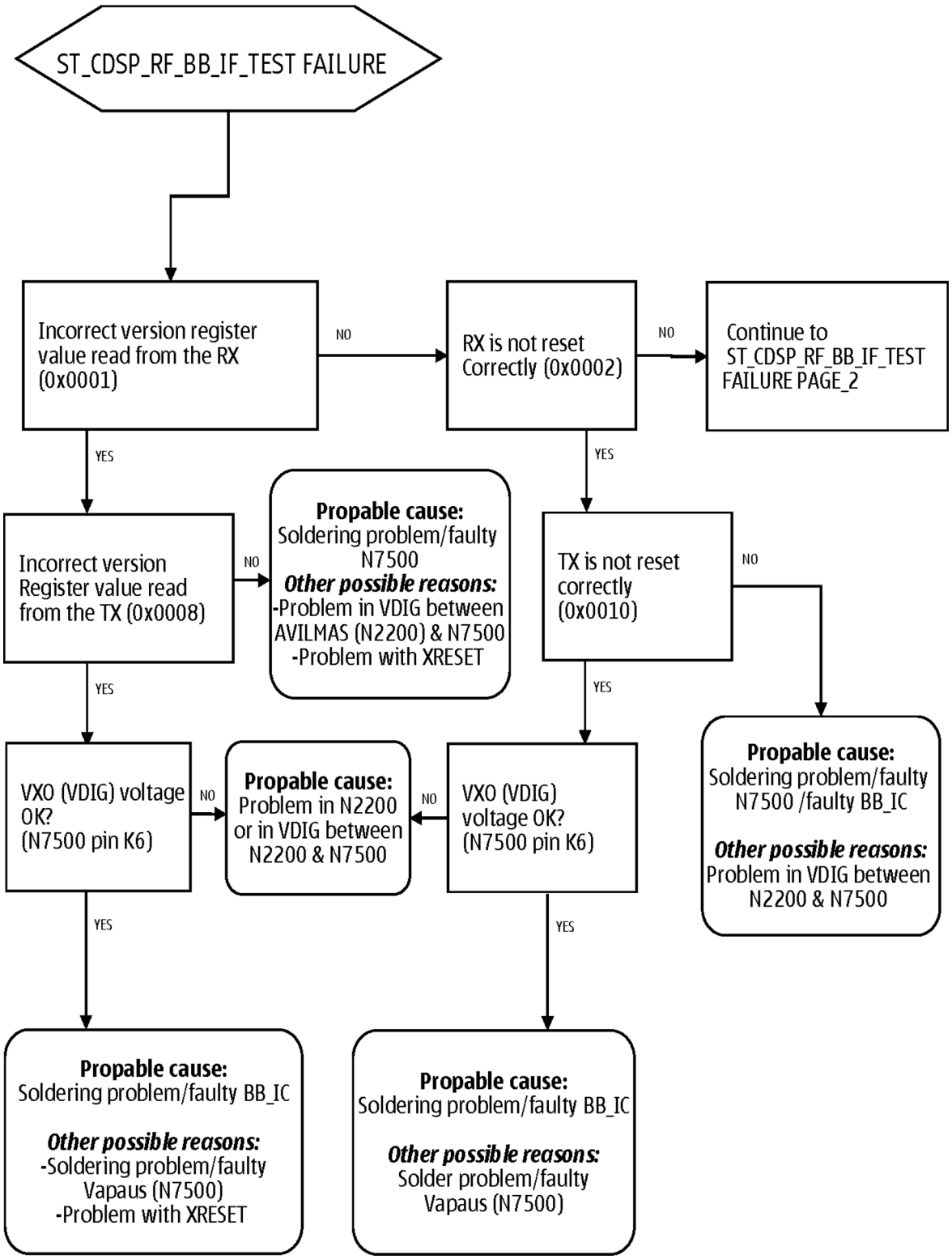
Sub-level flowcharts



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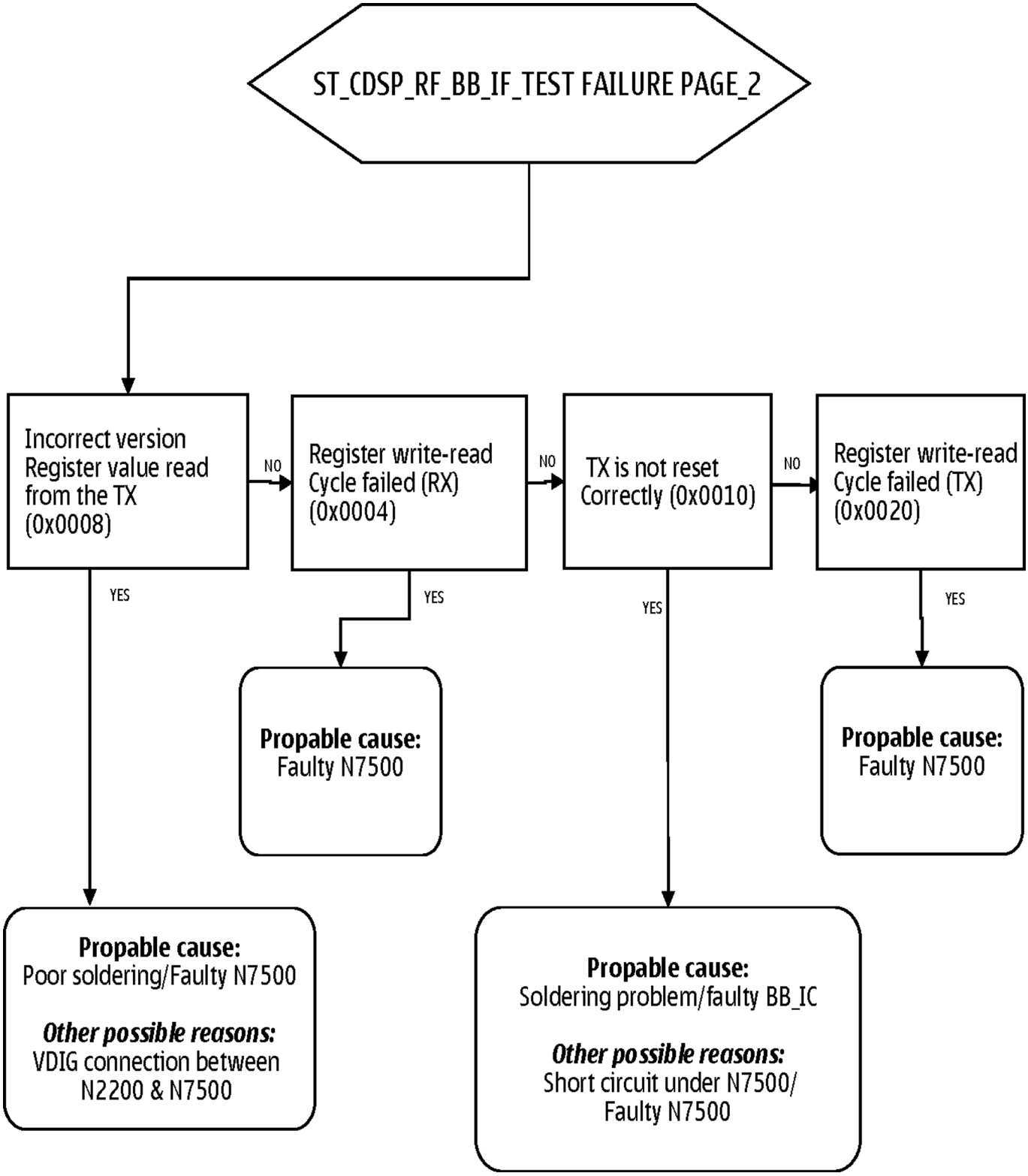

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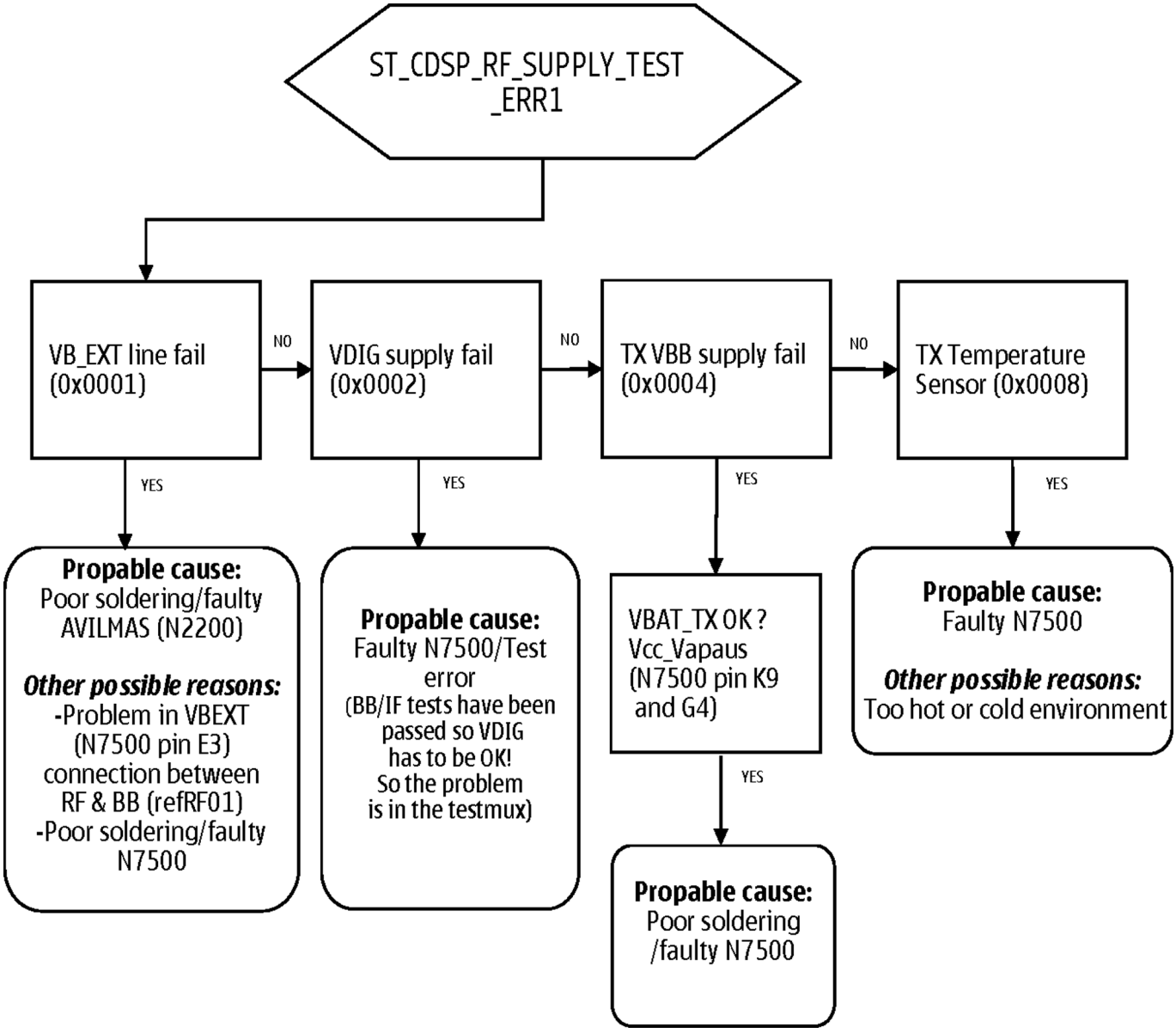

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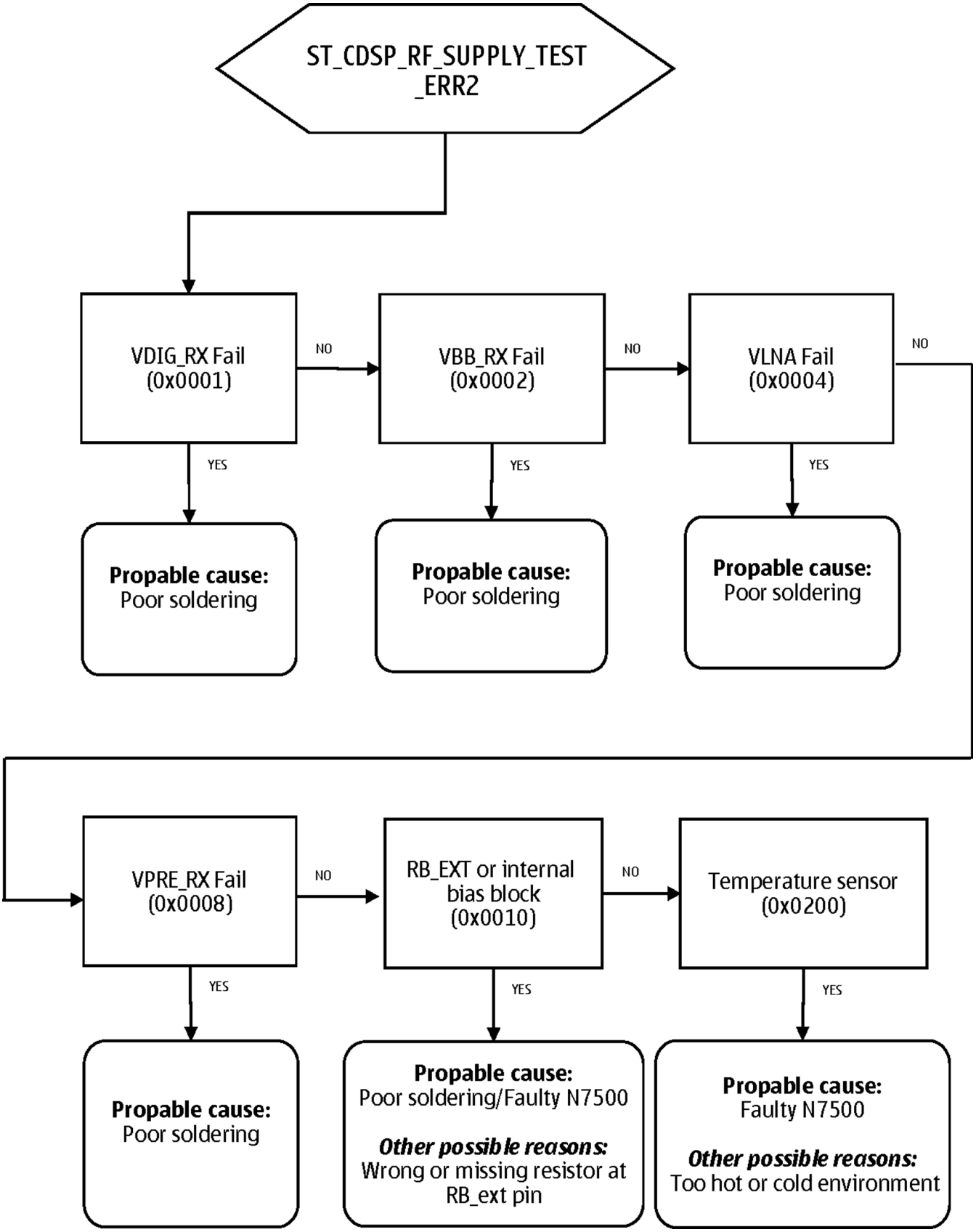

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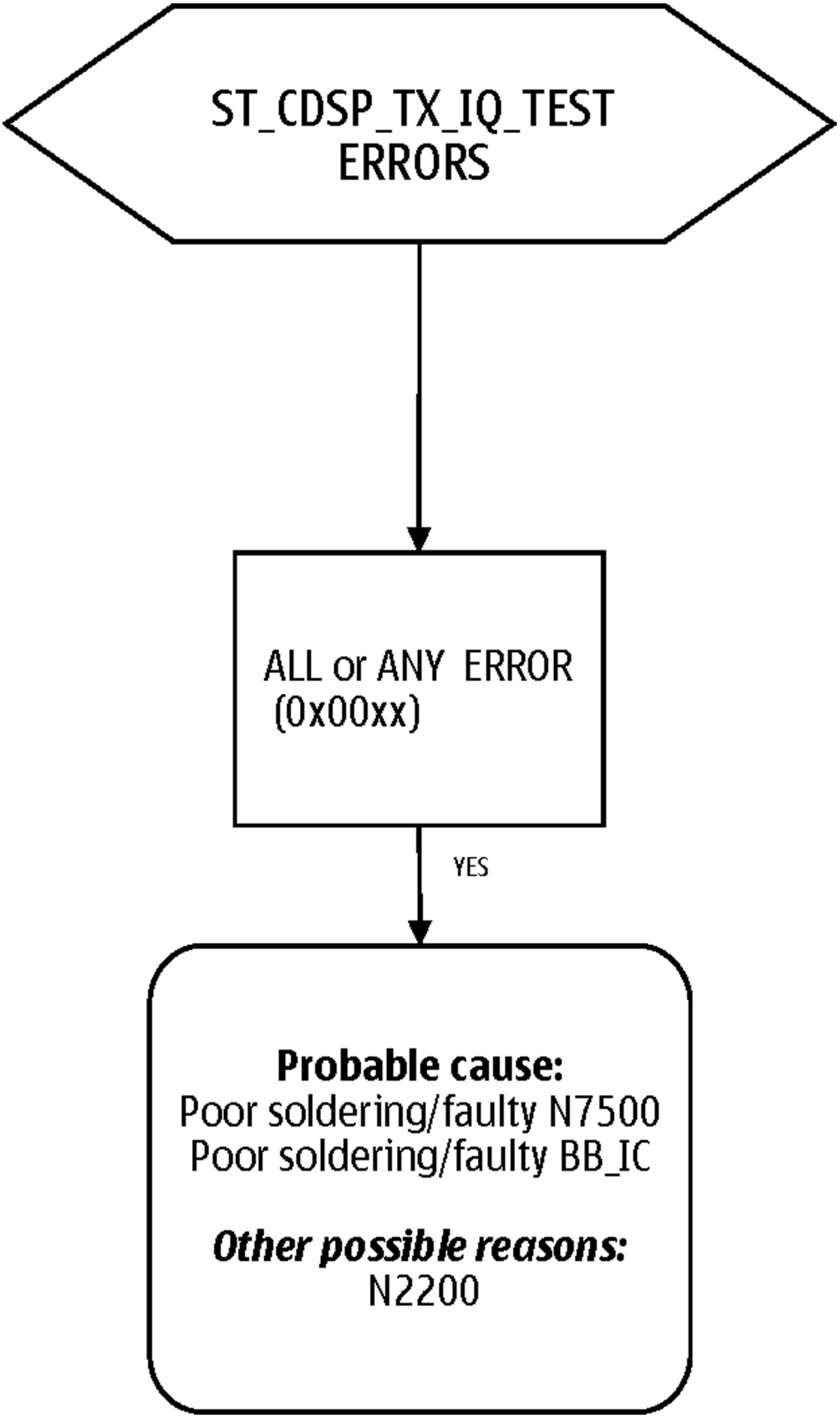

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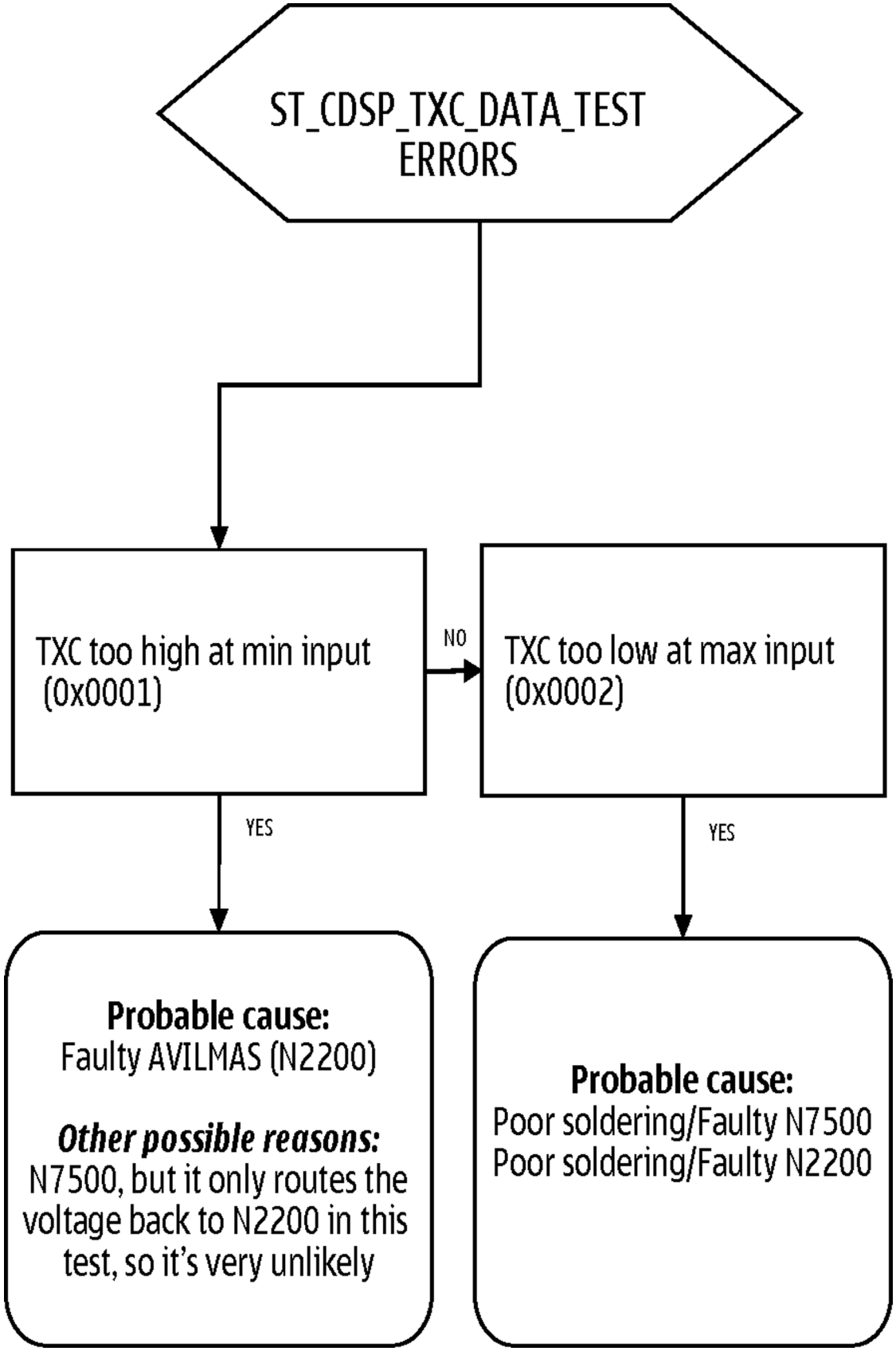

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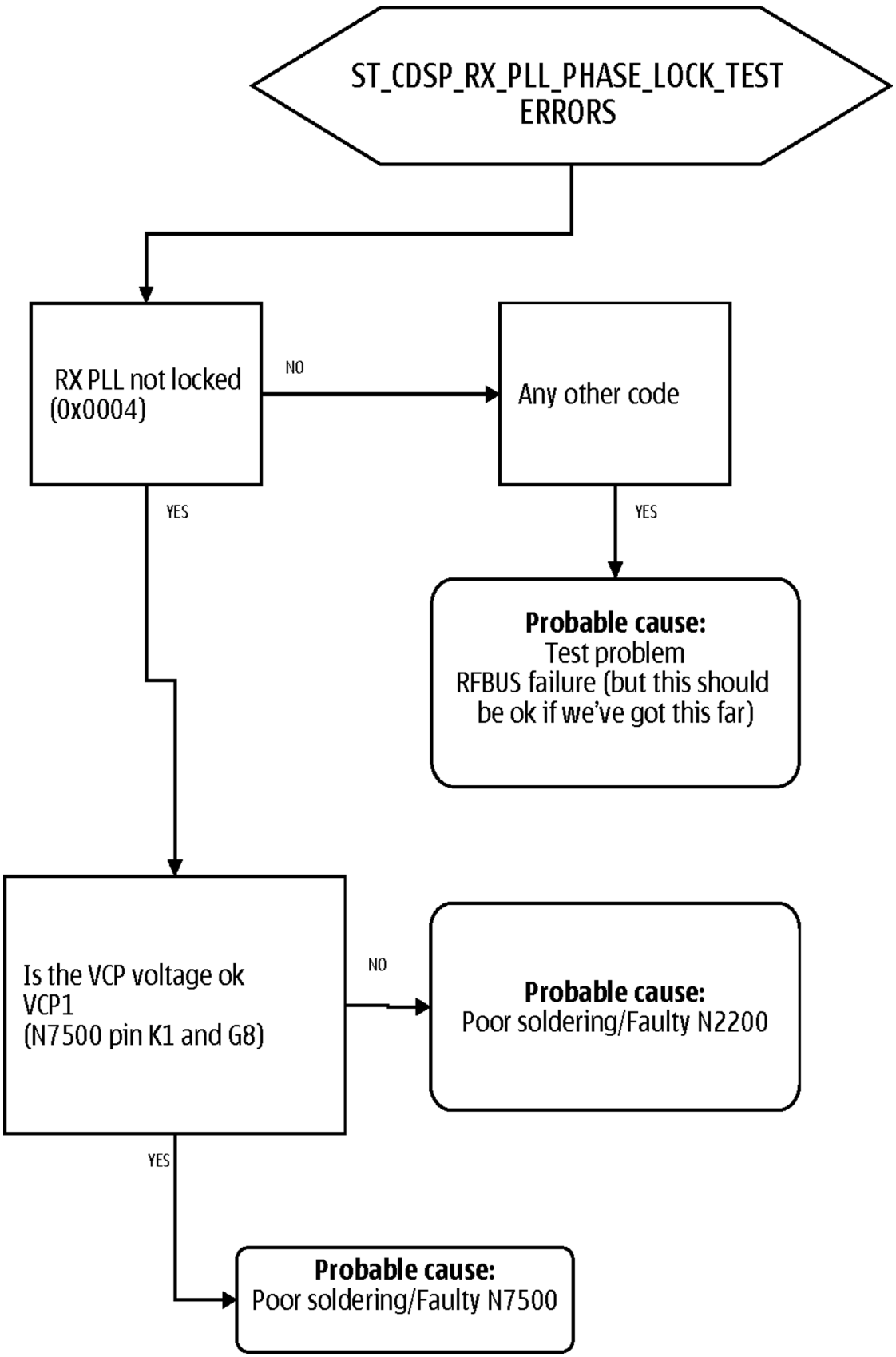

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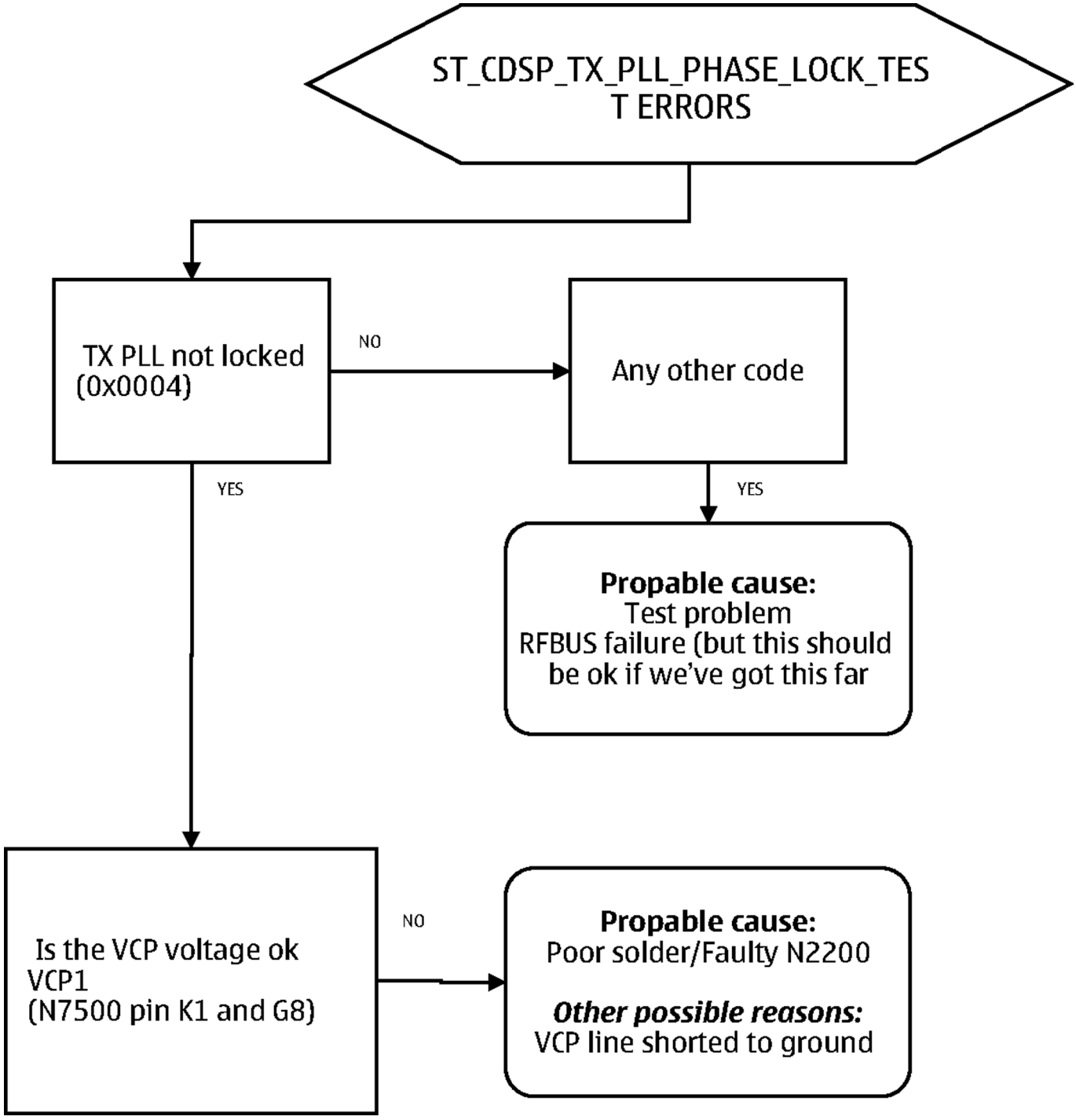

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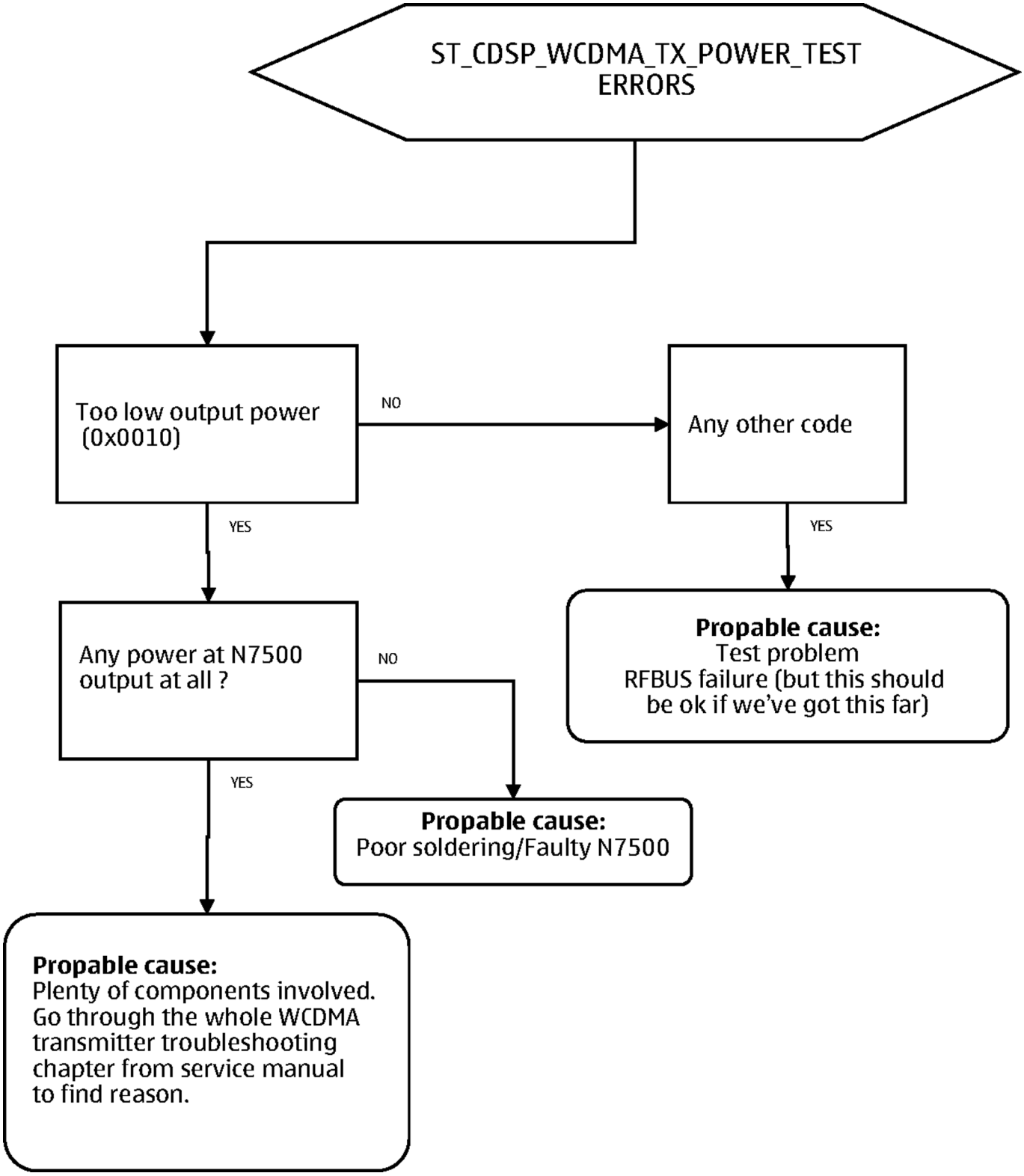

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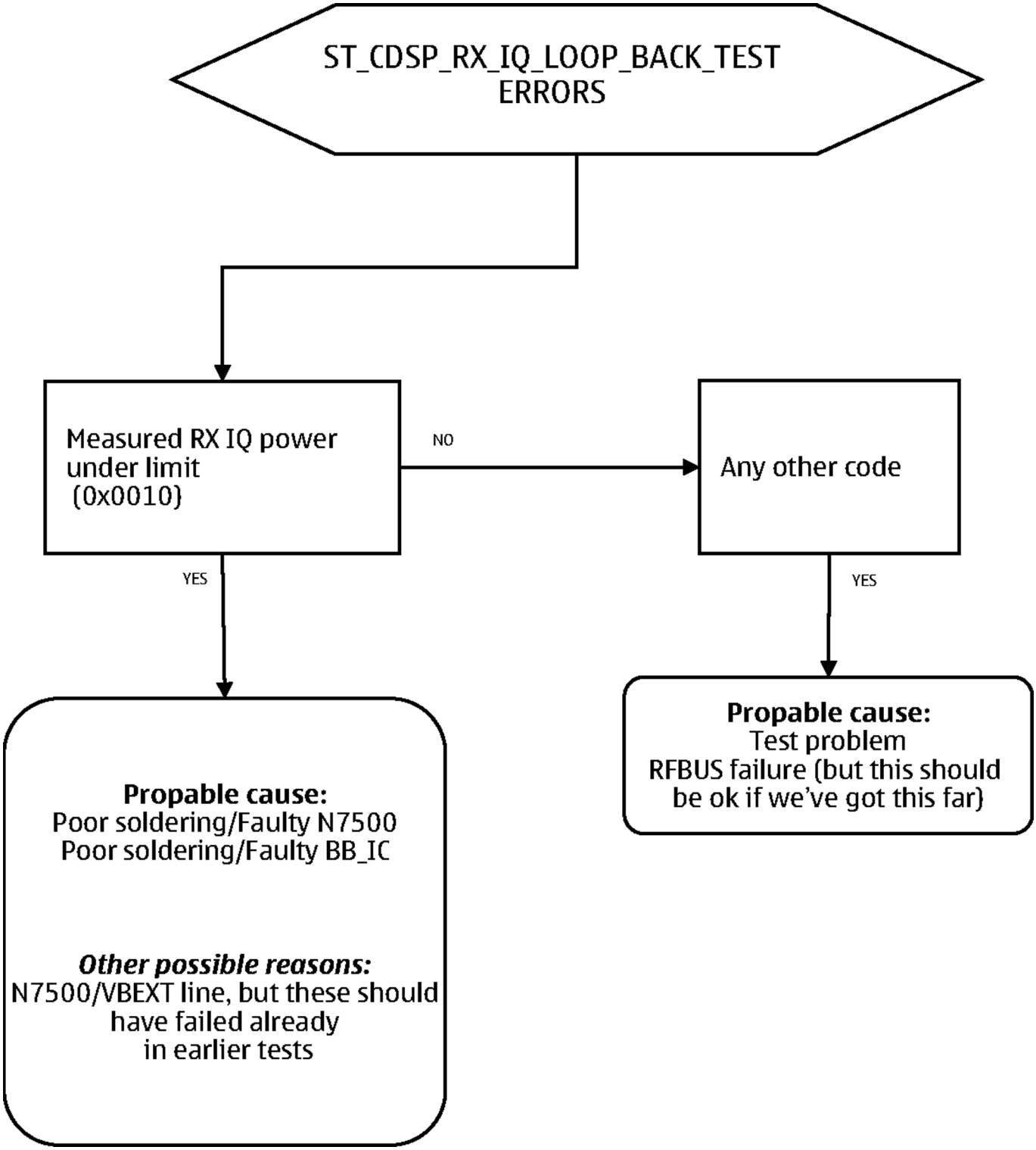

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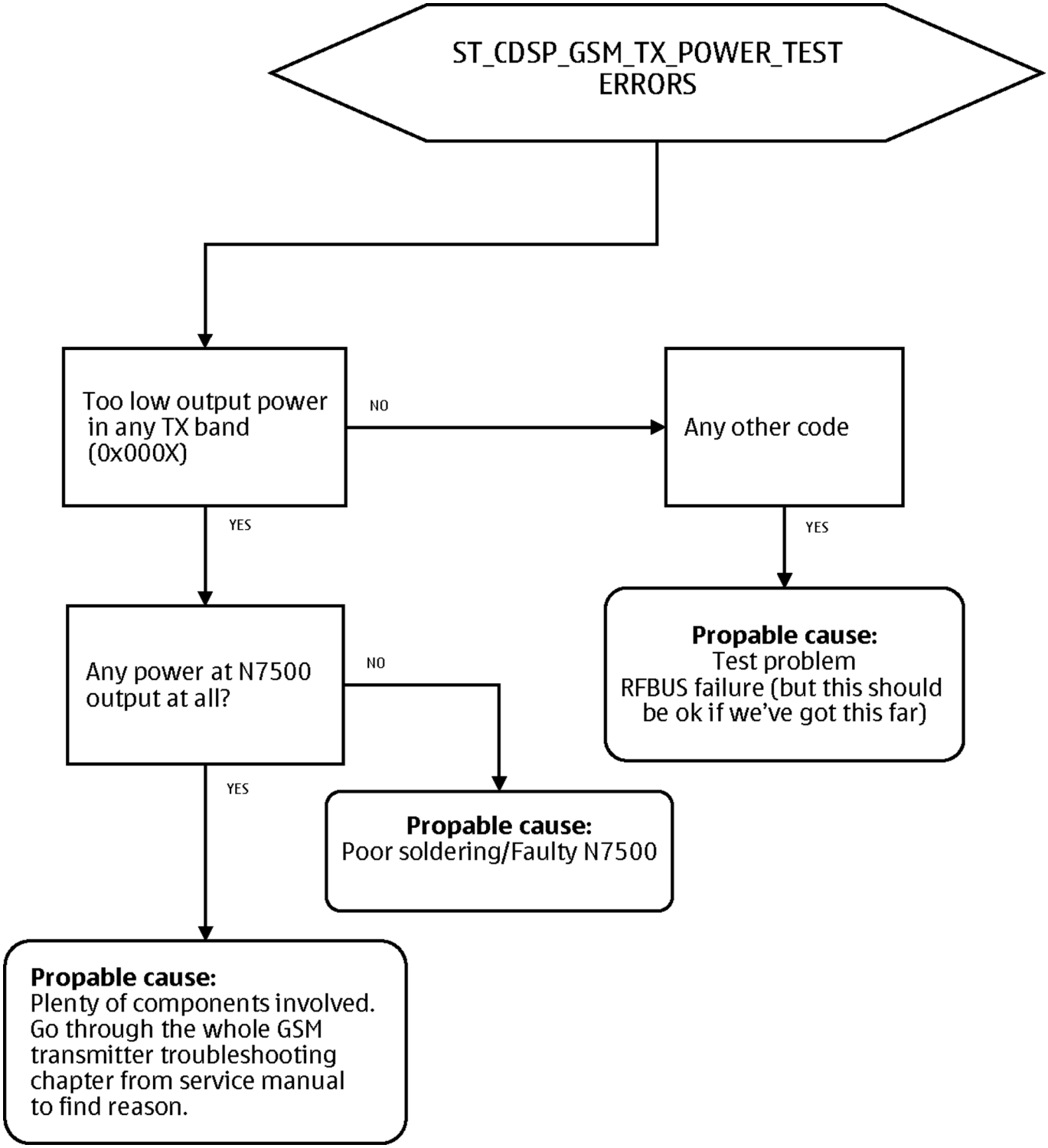

Receiver Troubleshooting

Introduction to receiver (RX) troubleshooting

RX can be tested by making a phone call or in local mode. For the local mode testing, use Phoenix service software.

The main RX troubleshooting measurement is RSSI reading. This test measures the signal strength of the received signal. For GSM RSSI measurements, see *GSM RX chain activation for manual measurements/GSM RSSI measurement*. For a similar test in WCDMA mode, see *WCDMA RSSI measurement*.

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GSM RX chain activation for manual measurements/GSM RSSI measurement

Prerequisites

Make the following settings in Phoenix service software:

Setting	GSM850	GSM900	GSM1800	GSM1900
Phoenix Channel	190	37	700	661
Signal generator to antenna connector	881.66771MHz	942.46771MHz	1842.86771MHz	1960.06771MHz
	(67.71kHz offset)	(67.71kHz offset)	(67.71kHz offset)	(67.71kHz offset)
	at -60dBm	at -60dBm	at -60dBm	at -60dBm

Steps

1. Set the phone to local mode.
2. Activate RSSI reading in Phoenix (**Testing→GSM→RSSI reading**)

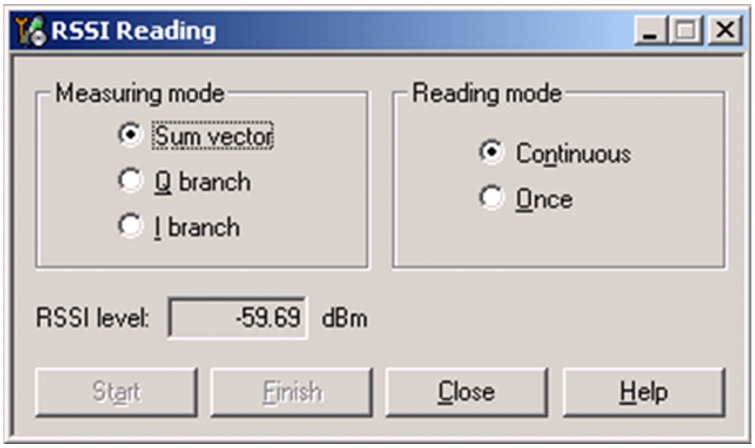

Figure 43 Phoenix GSM RSSI reading window

Results

The reading should reflect the level of the signal generator (-losses) +/- 5 dB.

When varying the level in the range -30 to -102 dBm the reading should then follow within +/-5 dB.

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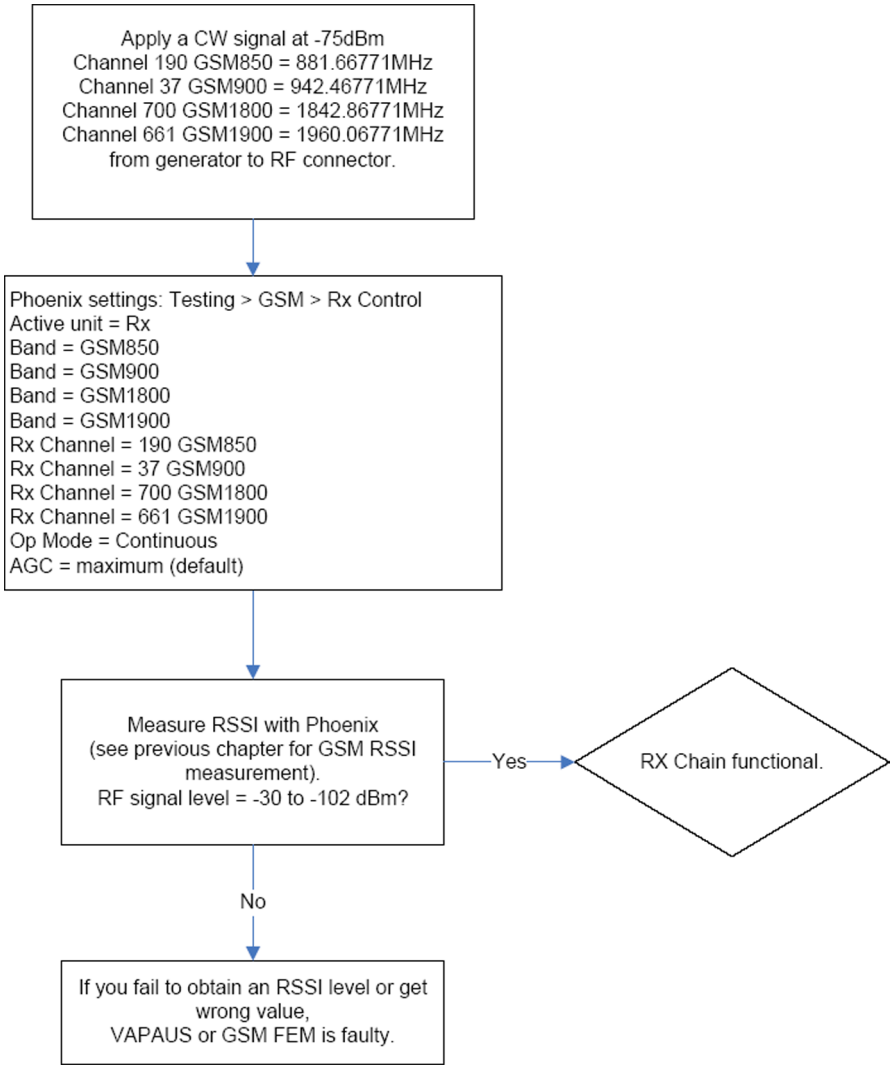
GSM receiver troubleshooting flowchart

Troubleshooting flow



WCDMA RX chain activation for manual measurement

Steps

1. Via Phoenix Testing menu, choose **WCDMA/RX Control**.
2. In the RX control window, make the following settings:

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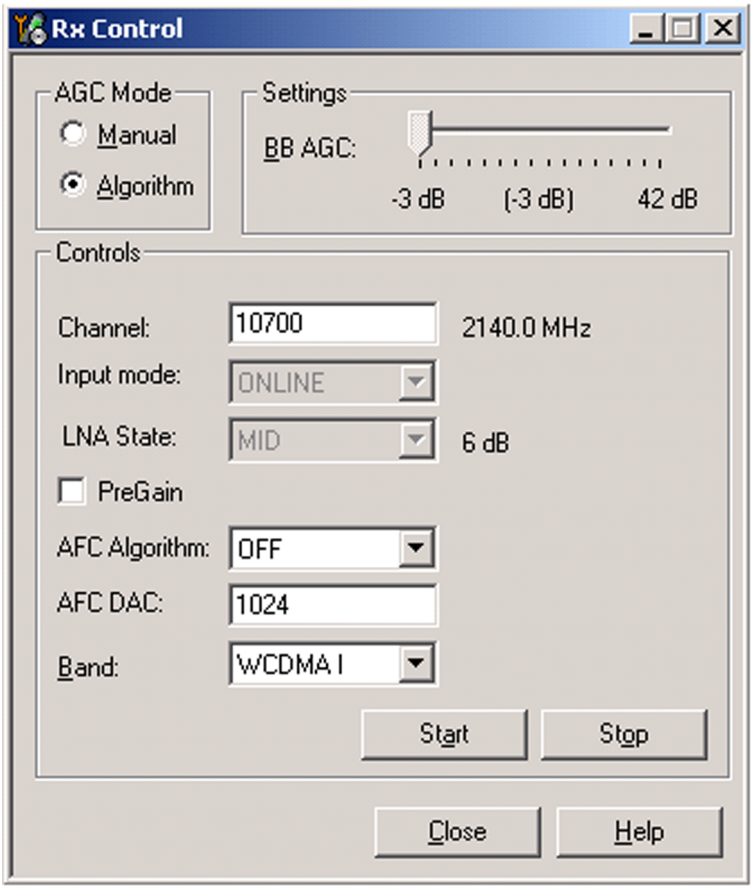

Figure 44 Phoenix WCDMA RX Control window

Note: Channel for band WCDMA II 9800, V 4408, VIII 3012

3. Click **Start** to activate the settings.

   If the settings are changed later on (for example, change of channel) you have to click **Stop** and **Start** again.

   Note: Clicking **Stop** also disables TX control if it was active.

WCDMA RSSI measurement

Prerequisites

WCDMA RX must be activated before RSSI can be measured. For instructions, please refer to WCDMA RX chain activation. Connect signal generator to RF connector and use appropriate frequency for each channel (2141MHz for channel 10700 WCDMA band I, WCDMA modulation).

Steps

1. Set the following RF generator settings:

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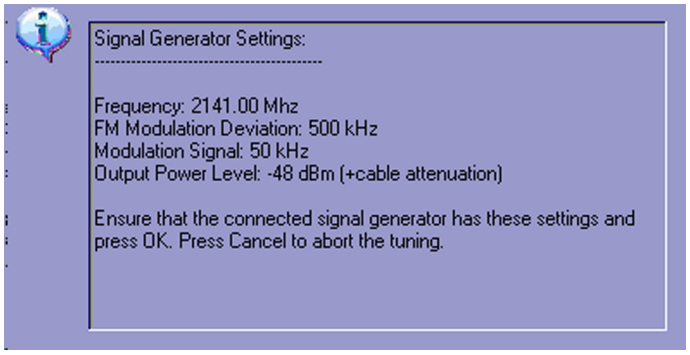

Figure 45 WCDMA RX generator settings

Note: Frequency for band WCDMA II 1961.0MHz, V 882.6MHz, VIII 943.4MHz

2. From the Phoenix testing menu, select **WCDMA→RX Power measurement**
3. In the RX power measurement window, make the following settings:

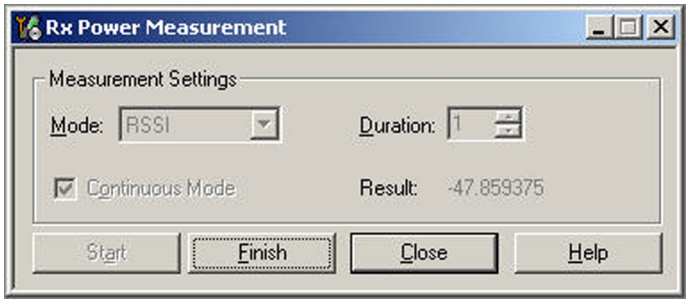

Figure 46 Phoenix WCDMA RX power measurement window

4. Click **Start** to perform the measurement.

Note: WCDMA RSSI measurement is accurate only with WCDMA modulated signal.

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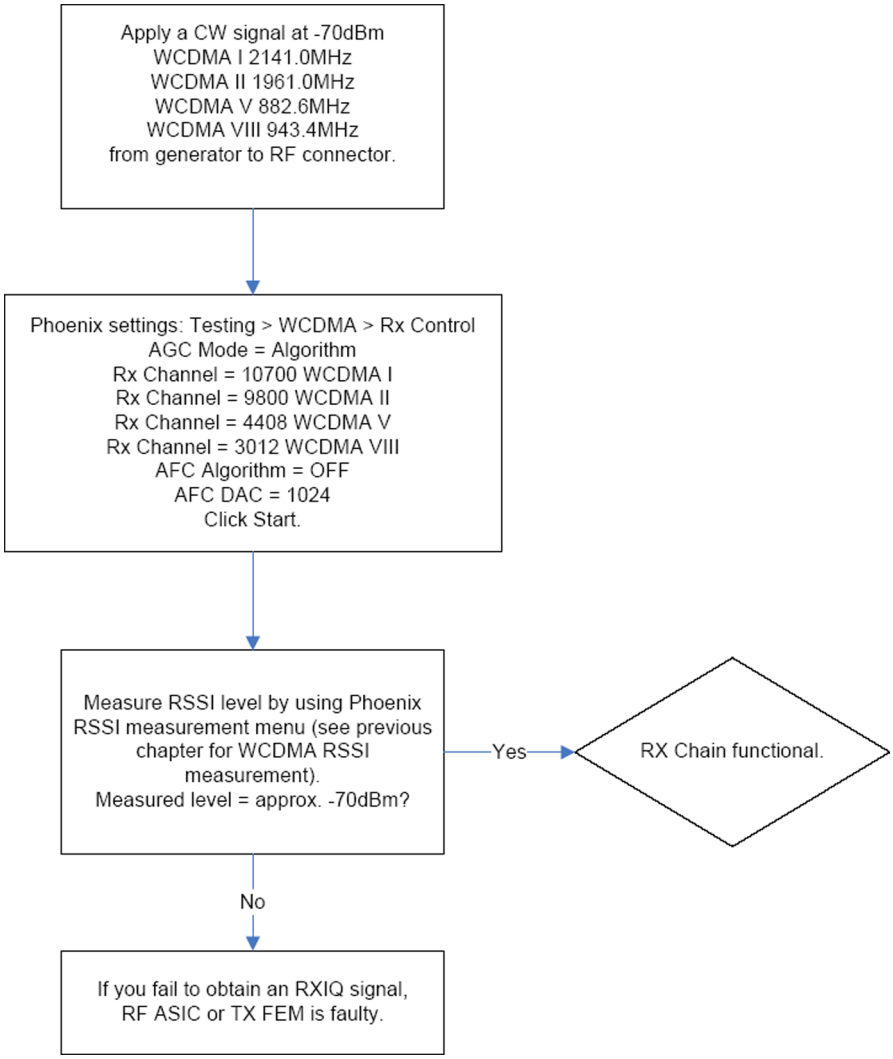
WCDMA receiver troubleshooting flowchart

Troubleshooting flow



Transmitter Troubleshooting

General instructions for transmitter (TX) troubleshooting

Please note the following before performing transmitter tests:

- TX troubleshooting requires TX operation.
- Do not transmit on frequencies that are in use.
- The transmitter can be controlled in local mode for diagnostic purposes.
- The most useful Phoenix tool for GSM transmitter testing is “RF Controls”, in WCDMA transmitter testing the best tool is “TX Control”.
- Remember that re-tuning is not a fix! Phones are tuned correctly in production.

Note: Never activate the GSM or WCDMA transmitter without a proper antenna load. Always connect a 50 Ω load to the RF connector (antenna, RF-measurement equipment or at least a 2 W dummy load); otherwise the GSM or WCDMA Power amplifier (PA) may be damaged.

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GSM transmitter troubleshooting

Steps

1. Set the phone to local mode.
2. Activate RF controls in Phoenix (**Testing→GSM→Rf Controls**).
   Make settings as shown in the figure:

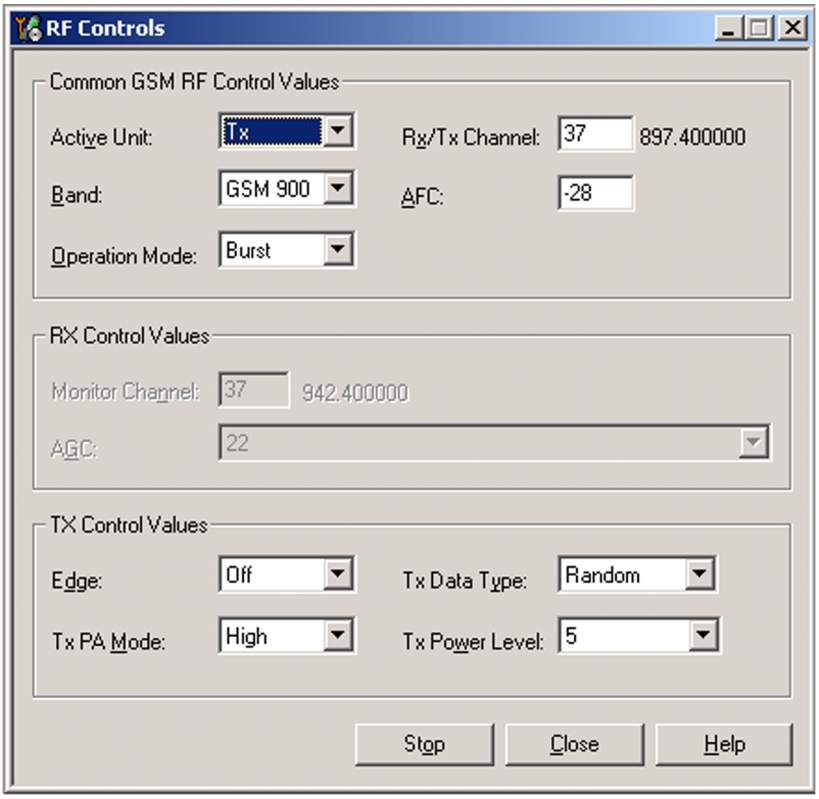

Figure 47 Phoenix GSM RF controls window

3. Check the basic TX parameters (i.e. power, phase error, modulation and switching spectrum), using a communication analyser (for example CMU200).

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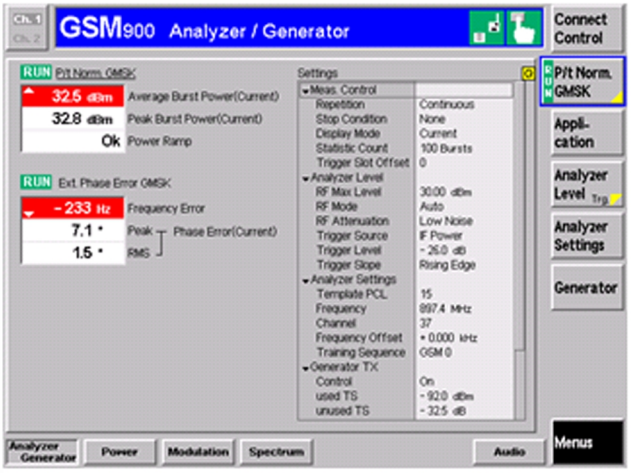
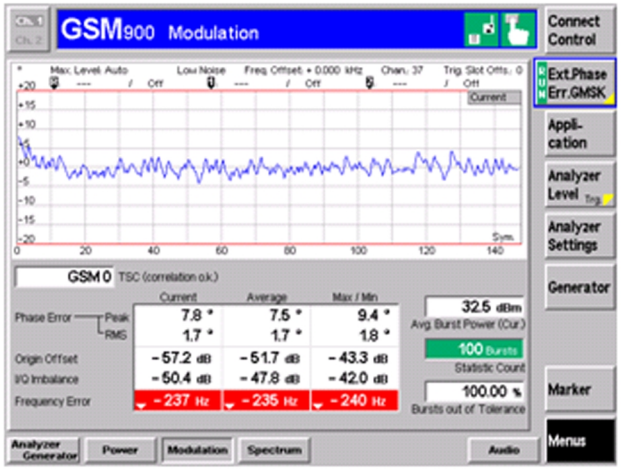
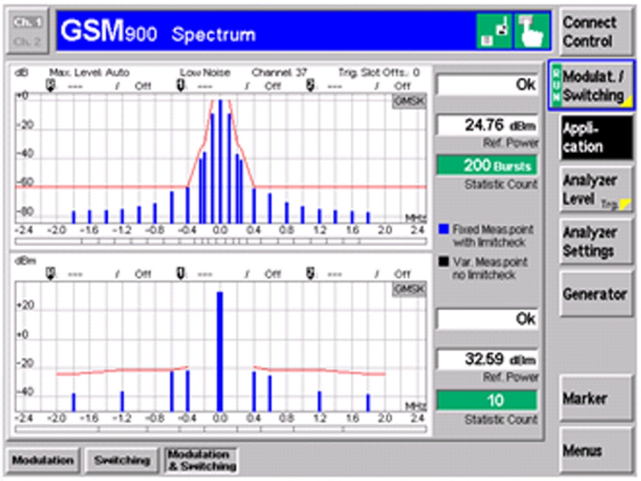
Analyser settings



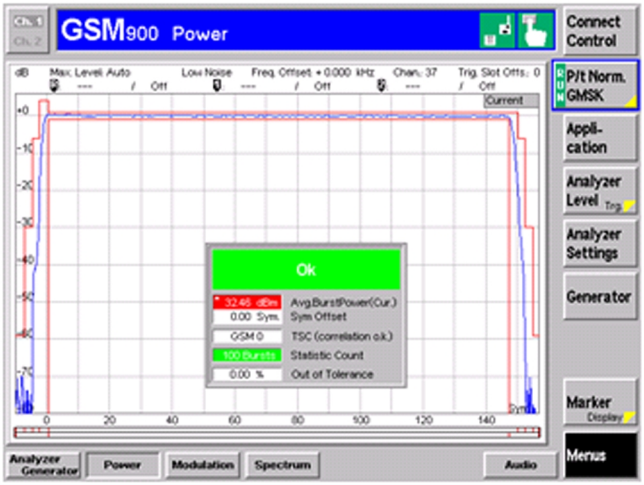
Phase error



Modulation/Switching spectrum



Power/Burst GSM/GPRS (GMSK)



Power/Burst - EDGE (8PSK)

4. Change power level (RF controls) and make sure the power reading follows accordingly.

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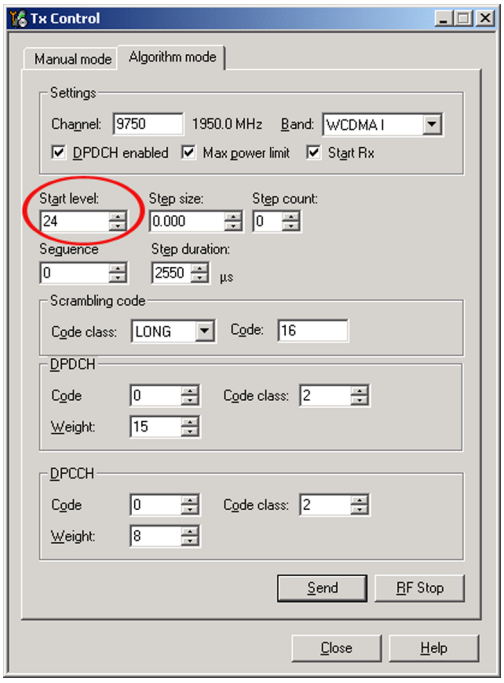
Next actions

If you want to troubleshoot the other bands, change band with RF controls and set the communication analyser accordingly.

WCDMA transmitter troubleshooting

Steps

1. Set the phone to local mode.
2. In Phoenix, select **Testing→WCDMA→TX control** .
3. In the TX control window, make settings as in the picture:



Note: For WCDMA TX channels: band V 4183, VIII 2787

4. Click **Send** to enable the settings and activate TX.

   If settings are changed (eg. new channel), you have to click **RF Stop** and **Send** again.
5. Check the basic TX parameters using a communication analyzer (for example CMU200).

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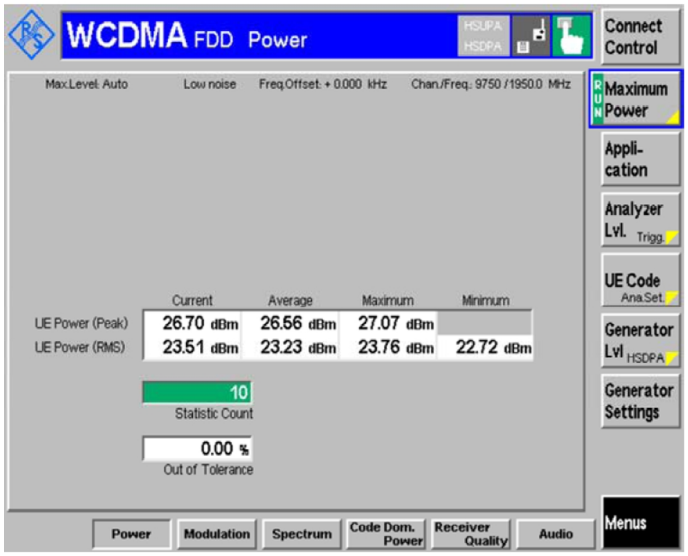
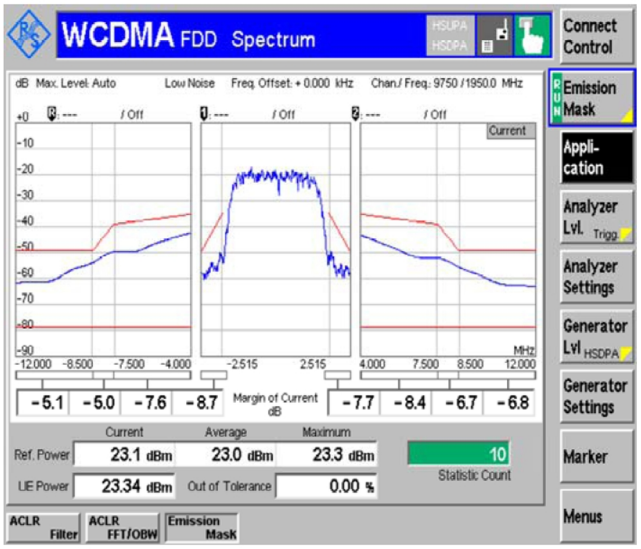
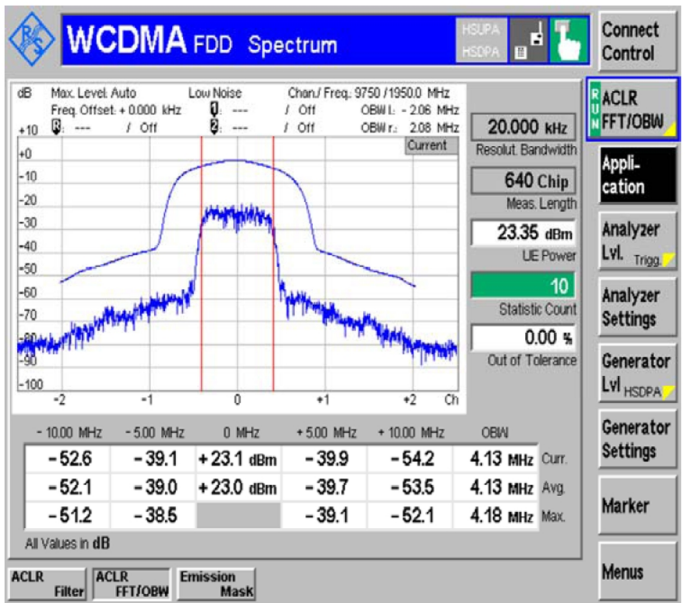
Power



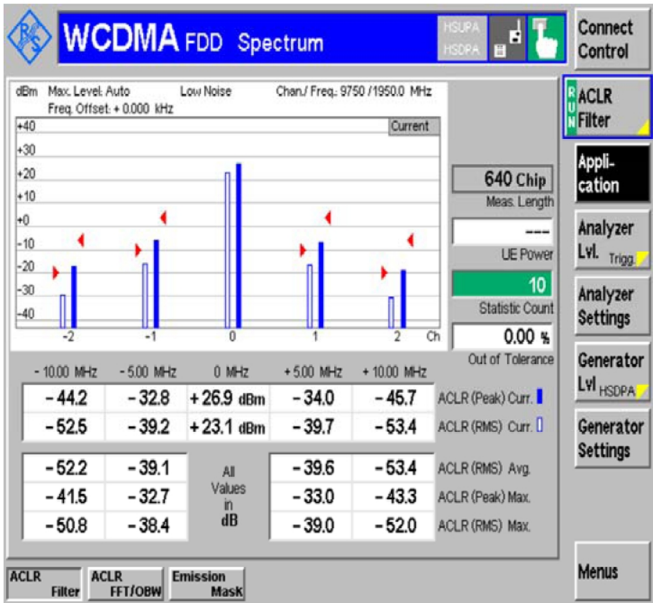
Spectrum - Emission Mask



Spectrum - ACLR (FFT/OBW)



Spectrum - ACLR (Filter)



Next actions

If you want to troubleshoot the other bands, change band with RF controls and set the communication analyser accordingly.

Antenna Troubleshooting

Antenna troubleshooting

Antenna contacts, visual check

In the main antenna there is one feed and two GND contacts. Check that GND and feed pads take proper contact to the C-clips on main PWB.

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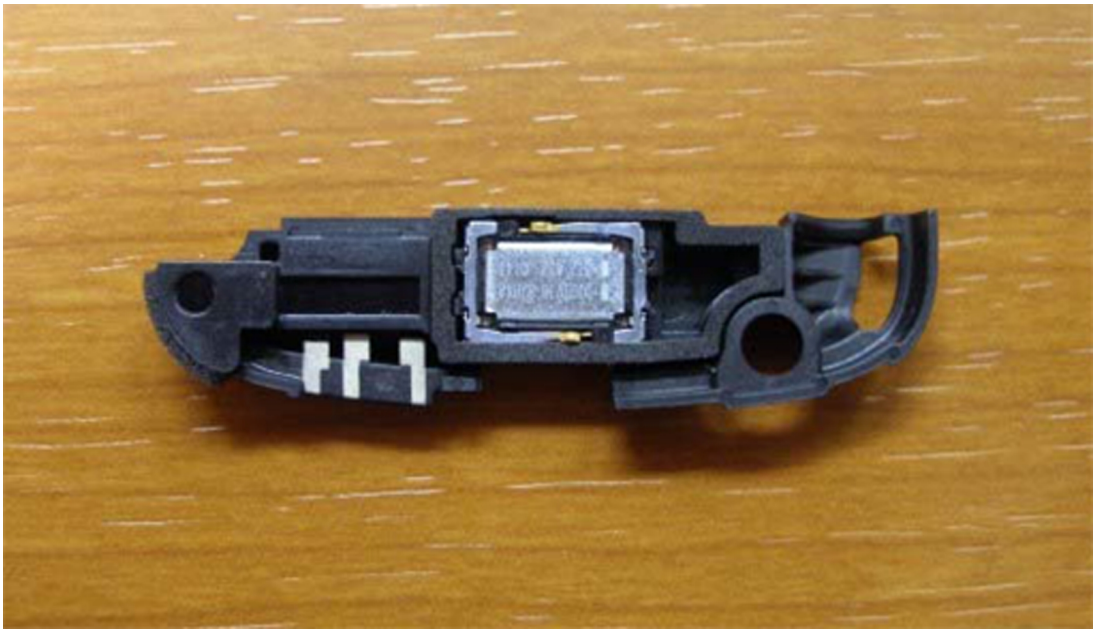

Figure 48 Antenna contacts

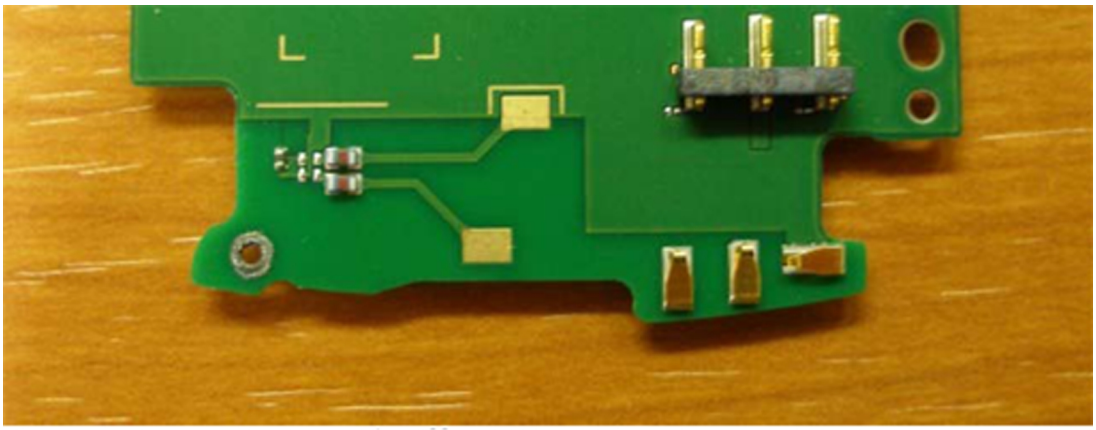

Figure 49 Antenna contact clips on PWB

Antenna matching components, visual check

There are four matching components on the PWB. Check visually that all components are properly soldered on the PWB. In case there is damage, you need to replace the damaged one.

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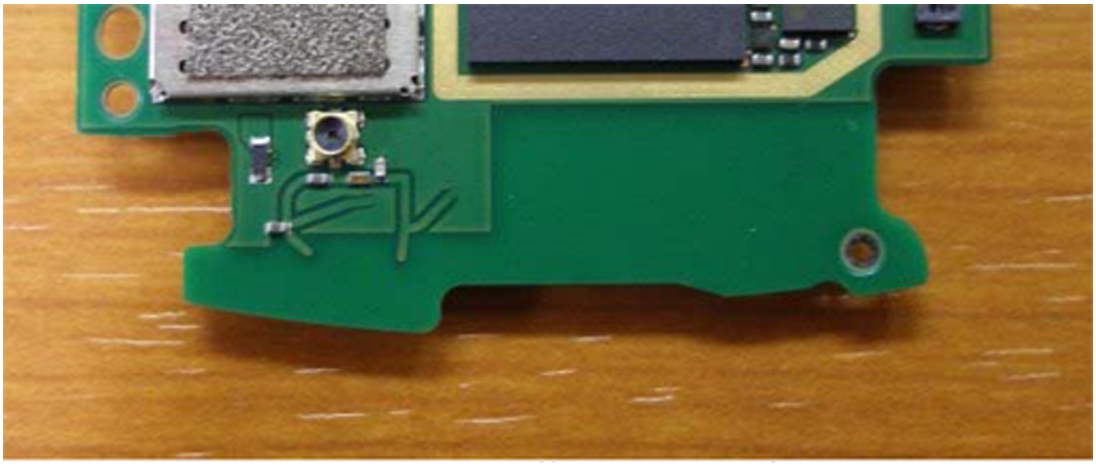

Figure 50 Antenna matching components on PWB

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5 — Camera Module Troubleshooting

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Camera troubleshooting overview

Camera troubleshooting is broken down into 2 parts, Phoenix automatic checks and Manual Checks. The main purpose of the Phoenix automatic check is to try and identify the fault automatically without any manual checks. If the Phoenix automatic flow is not providing enough information, manual checking can be performed to narrow down the fault.

Camera basic test points

The signal list below shows the camera basic tests points used in troubleshooting flow.

Sr. No	Signal name	Reference designator	Description
1	GND	GND	Ground
2	1.3V	C5423	1.3V
3	1.8V	C5442	1.8V
4	2.8V	C5440	2.8V
5	VBAT	C5424	VBAT
6	REG_EN	J5400	Regulator enable signal from host to HW accelerator
7	CAMCLK	R2854	Clock signal from host to HW accelerator
8	EXTCLK1	R5415	Clock signal from HW accelerator to Primary camera
9	EXTCLK2	R5414	Clock signal from HW accelerator to Secondary camera
10	XSHUTDOWN0	J1408	Shutdown from HW accelerator to Primary camera
11	XSHUTDOWN1	J1411	Shutdown from HW accelerator to Secondary camera
12	FLASH_EN	J1450	Flash enable signal from HW accelerator to Flash driver
13	FLASH_SYNC	J1451	Flash Sync signal from HW accelerator to Flash driver
14	LED ANODE	C5453	Anode of the Flash LED

Camera tests for Phoenix

Steps

1. The self tests can be executed from Phoenix test software. Connect the device to Phoenix, and select **Self Tests** from the **Testing** menu.

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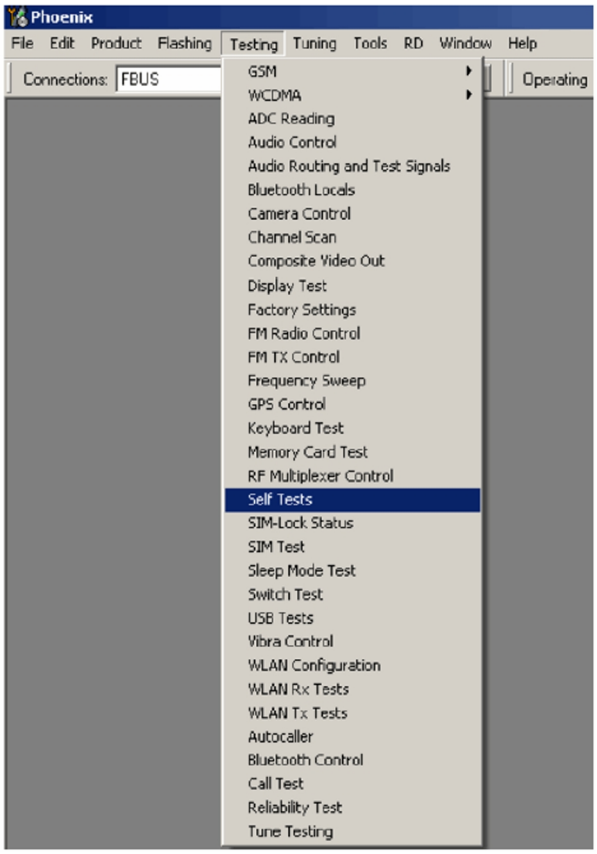
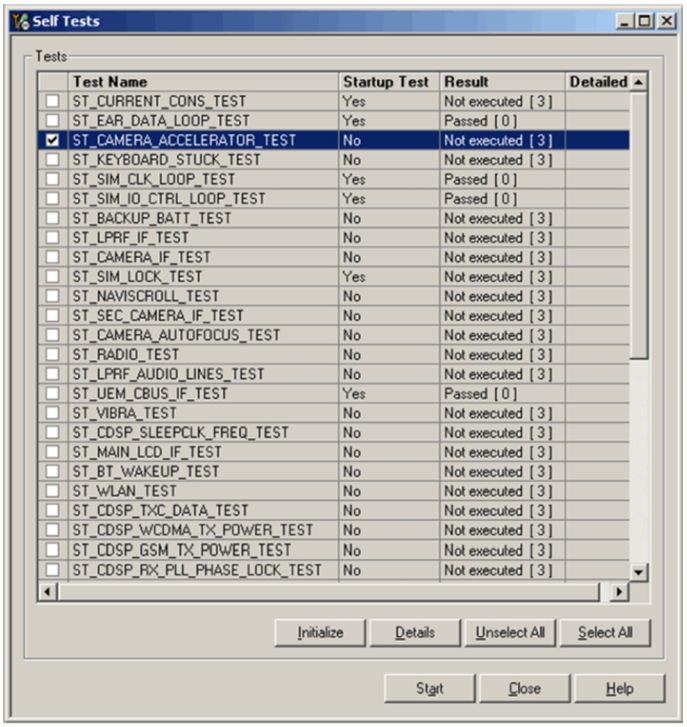


2. The following selection of tests will open (the visibility of the different tests depends on the device in question).



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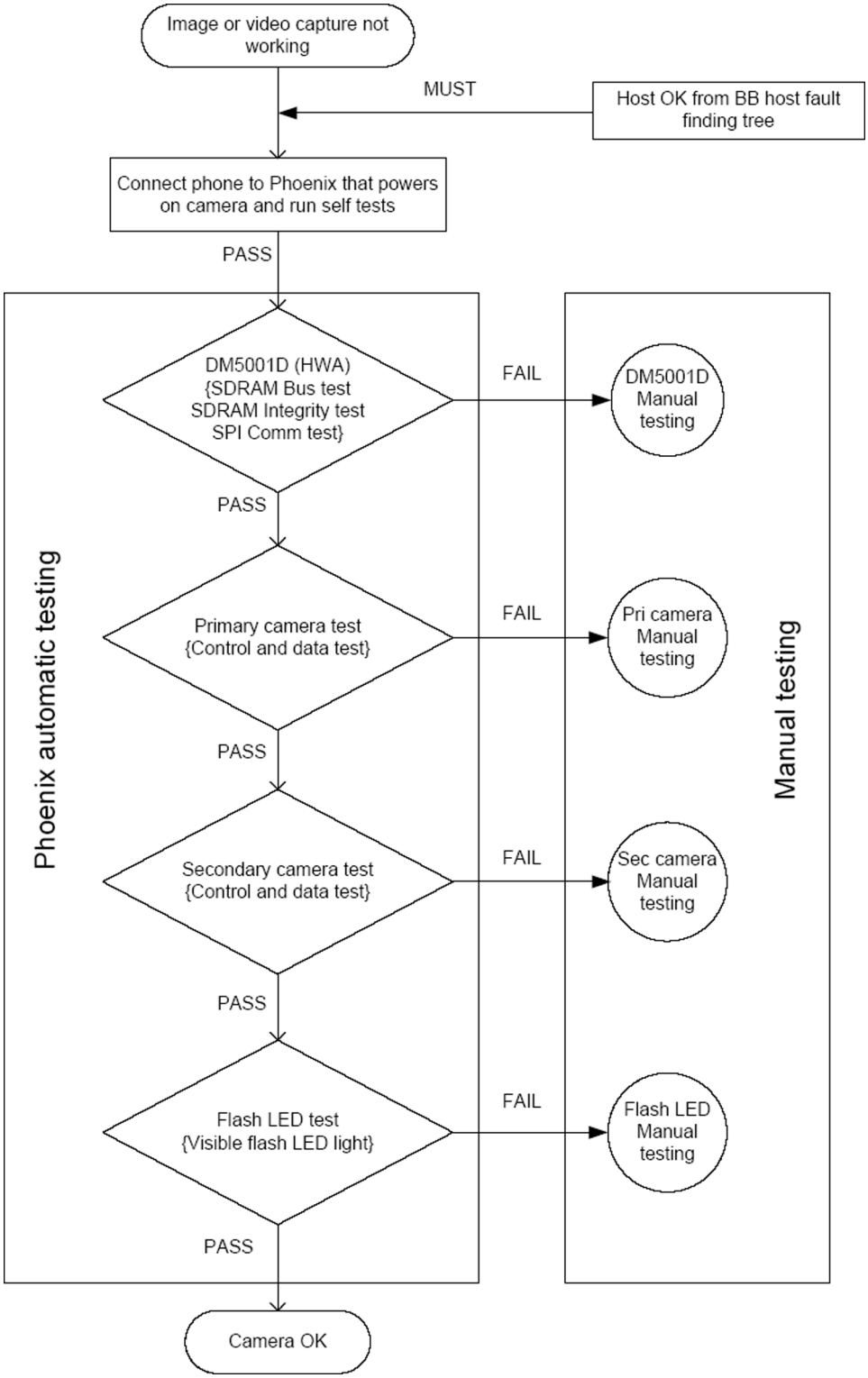
Camera troubleshooting flow

Troubleshooting flow



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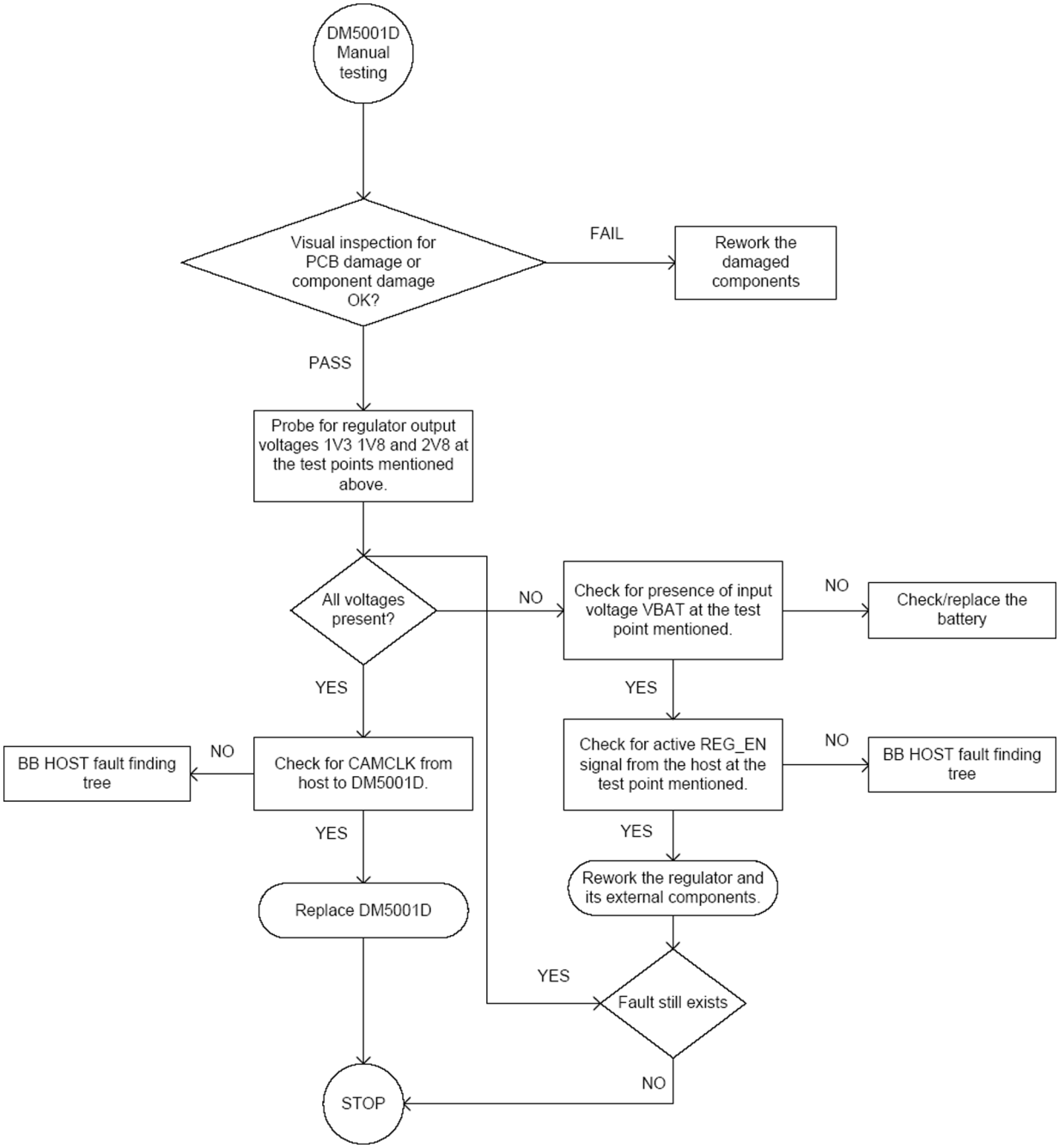
Camera HWA failure troubleshooting

Troubleshooting flow



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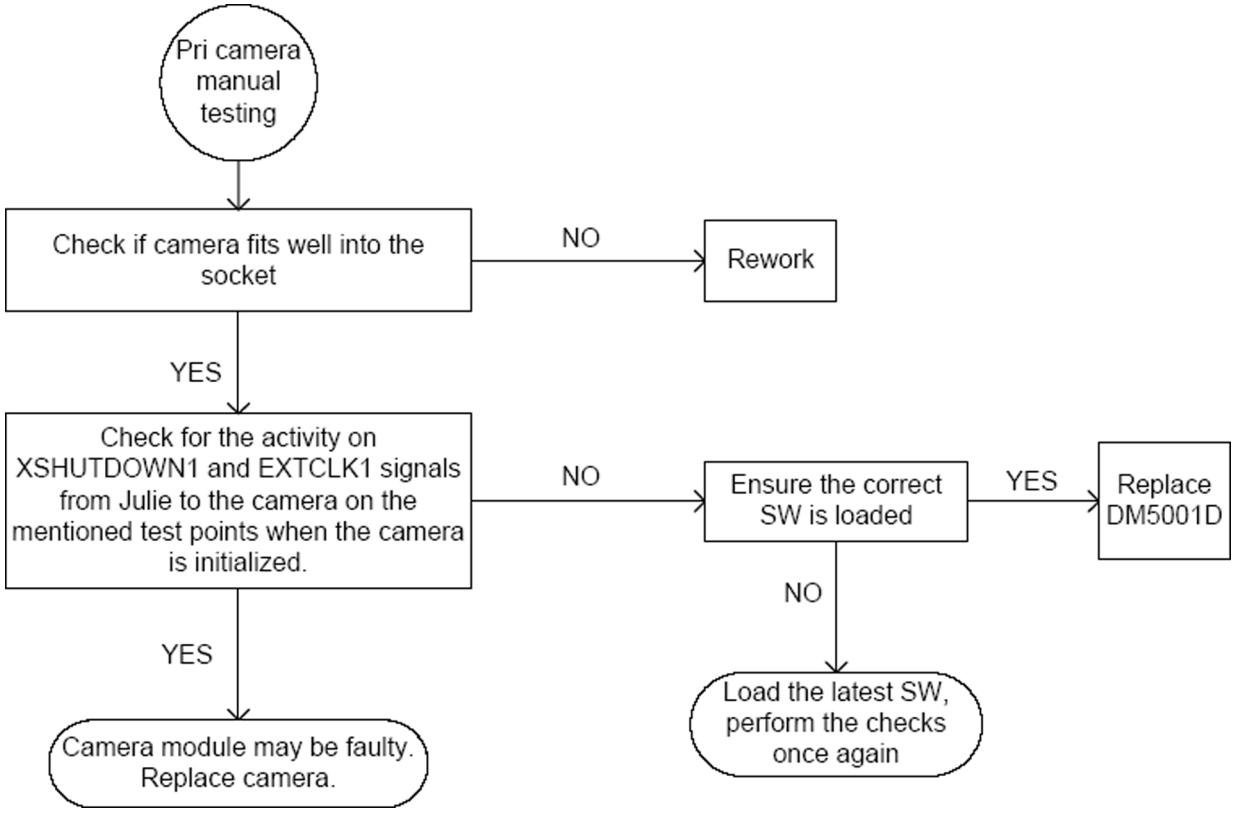
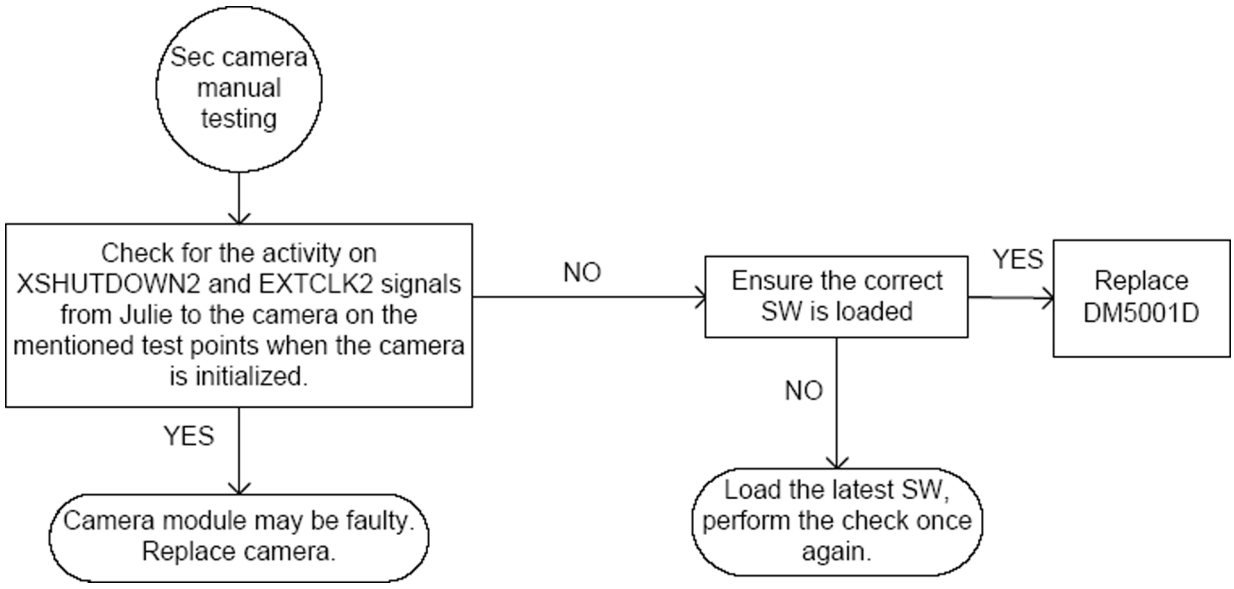
Main camera failure troubleshooting

Troubleshooting flow



Secondary camera failure troubleshooting

Troubleshooting flow



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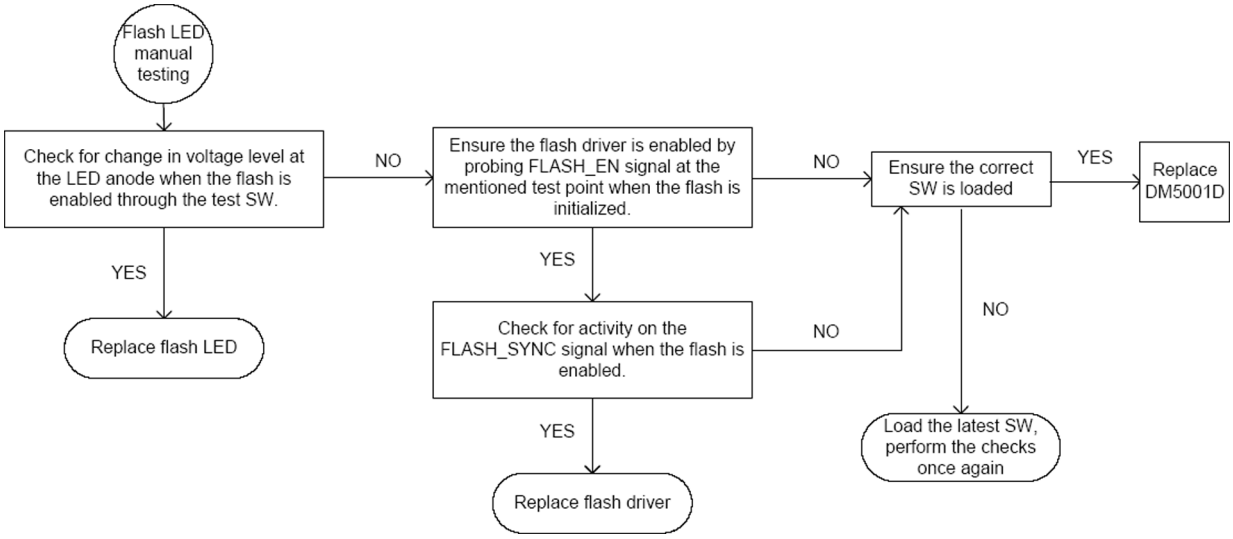
Flash LED failure troubleshooting

Troubleshooting flow



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6 — FMTx 2.1 Technical Description

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Glossary

AF	Audio Frequency
RF	Radio Frequency
FM	Frequency Modulation
Tx	Transmitter
Rx	Receiver
FMTx	FM Transmitter
LPD	Low Power Device
LNA	Low Noise Amplifier
LDO	Low Drop Out regulator
RSSI	Received Signal Strength Indicator (same as RPS)
RPS	Received Power Scan (Same as RSSI)
QFN	Quad Flat No-Lead

FMTx2.1 HW block

The FMTx 2.1 implementation is based on the Silicon Laboratories Si4713 low power FM transmitter device. This device has some state of the art features which have been utilised in the Nokia implementation. Apart from having excellent RF transmitter performance and exceptional AF performance the device offers a number of unique features, including the ability to retune the output stage of the device to ensure optimal matching between the Tx antenna and the output stage of the device.

Functional description

The FMTx 2.1 solution comprises of the Si4713 device and 11 external components. These components consist of:

- A filter - an inductor and a varistor for filtering of emissions from the chip
- A dual capacitor package which is connected to the analogue audio input pins LIN & RIN. The fundamental purpose of these capacitors is as DC blocking caps
- A filter on the reset line comprising a capacitor and a resistor
- An antenna which also provides the inductive load required by the Si4713 device

The Si4713 device is in a 3 x 3mm 20 pin QFN package.

Current implementations make use of the DAC33 device which allows data to be digitally clocked into the DAC at high data rates, buffered and then streamed out at the correct rate while the rest of the baseband is put to sleep in order to save power. This solution significantly increases playback time of audio content.

The Si4713 device has the following features:

- 88.1MHz – 107.9MHz FM band support.
- Programmable pre-emphasis (50/75us).
- Analogue audio interface
- Audio silence/signal present detection.
- Programmable reference clock.

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- RDS/RBDS encoder
- Loop and monopole antenna support with self-calibrated capacitor tuning.
- Programmable transmit level.
- Audio dynamic range control.

System block diagram

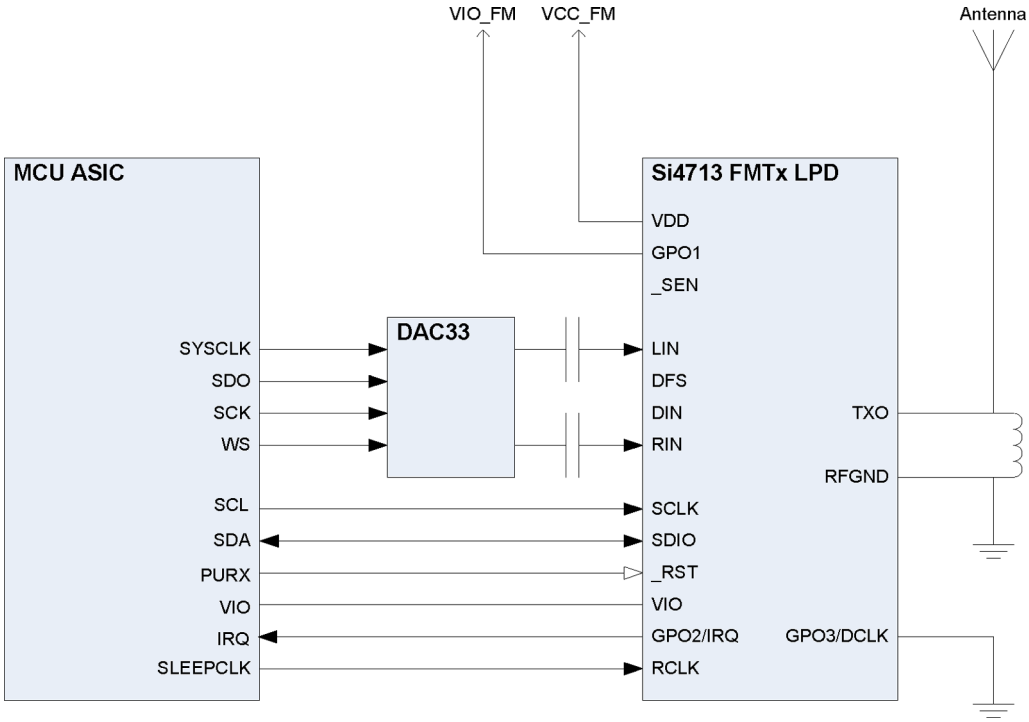

Figure 51 FMTx 2.1 system block diagram

The figure above shows the basic system block diagram for the FMTx 2.1 implementation. _SEN is shown here unconnected since this pin decides which I2C address is used depending on if this pin is pulled low or high.

The phone uses a loop antenna which is located in the removable C-cover of the device. The loop antenna also acts as the tuning inductor which is required by the Si4713 chip. The location of the antenna in the removable cover means that ESD protection is required to prevent damage to the Si4713 device.

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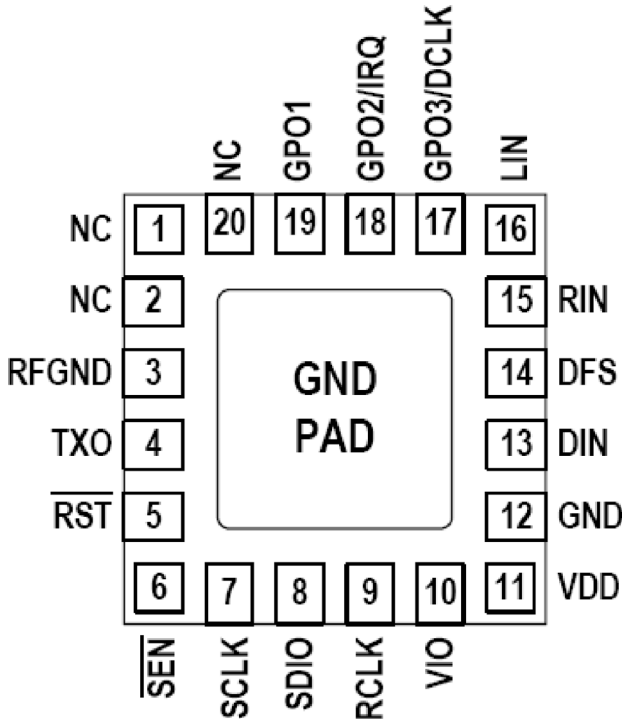
Device pin layout (Si4713-GM) and interfaces



Inteface pin descriptions

Pin Number(s)	Name	Description
1, 2, 20	NC	No connect, left floating.
3	RFGND	RF ground. Connected to ground plane on PCB.
4	TXO	FM transmitter output connection to Tx antenna.
5	RST	Device reset (active low) input.
6	SEN	Serial enable input (active low).
7	SCLK	Serial clock input.
8	SDIO	Serial data input/output.
9	RCLK	External reference oscillator input.
10	VIO	I/O supply voltage.
11	VDD	Supply voltage.
13	DIN	Digital input data.
14	DFS	Digital frame synchronisation.
15	RIN	Right audio line input.
16	LIN	Left audio line input.
17	GPO3/DCLK	General purpose output – Digital bit synchronous clock.

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Pin Number(s)	Name	Description
18	GPO2/IRQ	General purpose output – Interrupt request.
19	GPO1	General purpose output.
12, GND PAD	GND	Ground. Connect to ground plane on PCB.

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7 — FMTx 2.1 Troubleshooting

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FMTx 2.1 schematic

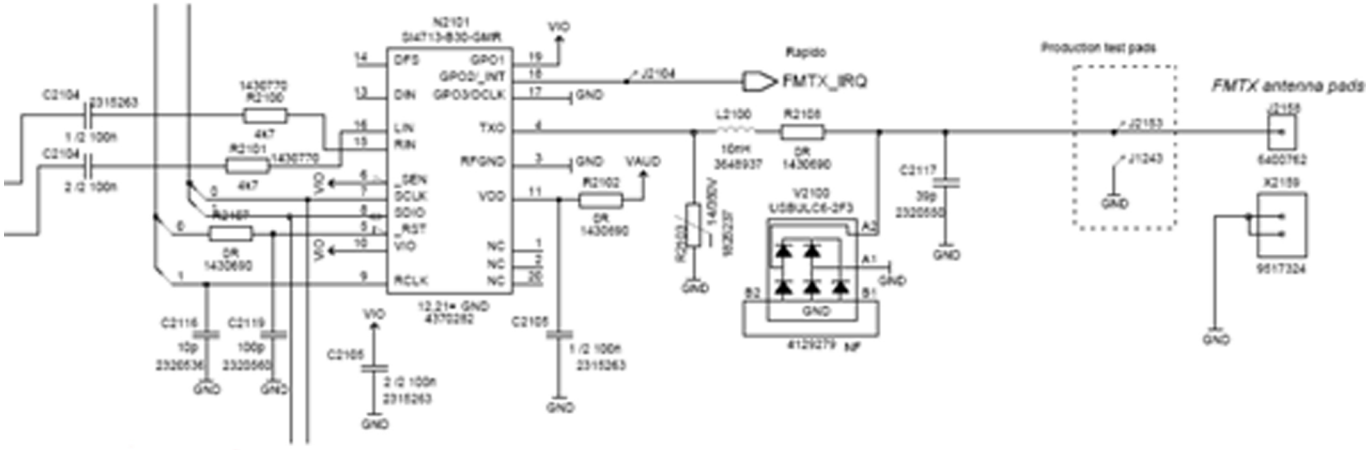

Figure 52 FMTx 2.1 schematic

The handset uses an antenna that is integral to the C-cover.

The loop antenna requires two connection points, J2158 and X2159 (the signal and the ground). It is important to check these connection points for damage or dirt since the performance of the FMTx 2.1 implementation will be severely impaired if these connections are not in good condition.

FMTx 2.1 component layout

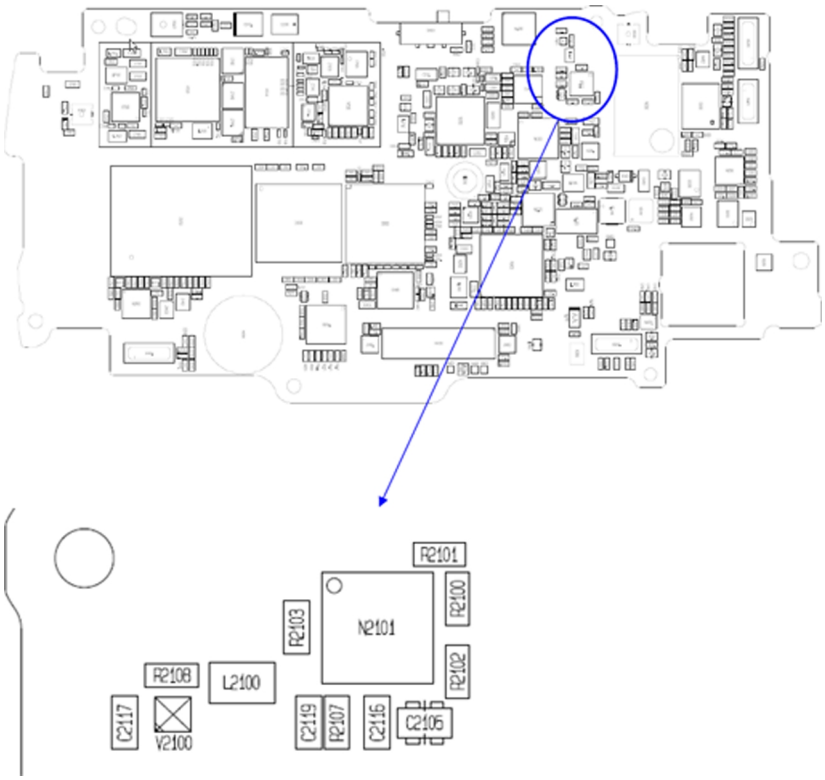

Figure 53 FMTx 2.1 Component References and Location

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The main component of the FMTx 2.1 solution is the Si4713 low power transmitter device (N2101). Two connection points, J2158 and X2159 (the signal and the ground) for the loop antenna are located on the other side.

FMTx 2.1 PWB traces

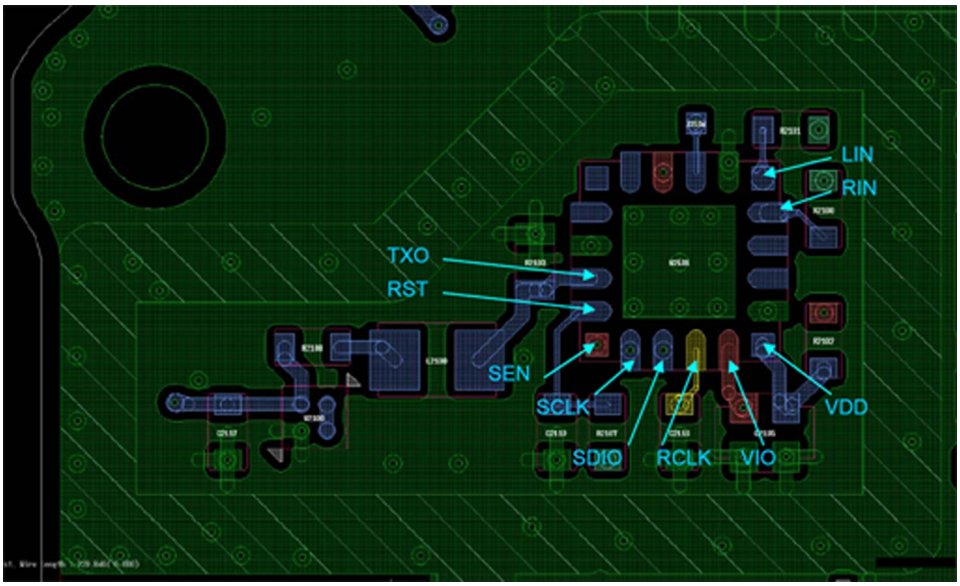

Figure 54 FMTx 2.1 layout

Specific digital and power supply test points

Using access to signals figure as a reference it can be seen that supplies to the Si4713 device VIO (pin 10) and VDD (pin 11) can be accessed easily. The FMTx 2.1 solution utilises a QFN package. This type of package lends itself well to analysis of signals on the various pins of the device.

VIO & VDD

VIO should be in the range 1.5 to 3.6 Volts.

VDD should be in the range 2.7 to 5.5 Volts.

_RST

Also, the _RST signal to the device can be monitored. This is an active low signal and should only be asserted during power up. The _RST signal is driven by the PURX line.

The state of pins 19 & 18 (GPO1 and GPO2 respectively) on the rising edge of the _RST pin determines what interface is selected when the device powers up.

Table 10 Bus mode selection truth table

Bus Name	Bus Mode	GPO1	GPO2/IRQ
I2C	2-Wire	High	Low
SPI	SPI	High	Low (must drive)
CBus	3-Wire	Low (must drive)	Low

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It's possible that if GP01 and/or GP02 are not at the correct state when the Si4713 device has power applied then the wrong bus mode could be selected and the handset would be unable to communicate with the device.

_SEN

The _SEN pin is used to select one of two possible 7-bit I2C bus addresses. When _SEN is low, the I2C bus address for the Si4713 device is 0010001 (0x11). When _SEN is high, the I2C bus address for the Si4713 is 1100011 (0x63).

If the _SEN signal is not correct (i.e. not selecting the correct I2C address), then this is also another possible reason why control of the FMTx 2.1 feature might not be possible.

Table 11 I2C 7-bit bus address selection summary

I2C address	_SEN
0010001 (0x11).	High
1100011 (0x63).	Low

FMTx2.1 specific RF test points

TXO

Pin 4 is the TXO pin. This is the transmitter output pin and probe access can be obtained easily. Using a high impedance probe and a spectrum analyser it would be possible to examine the TXO pin and check that the transmitter is outputting a signal.

Specific clock test points

RCLK

Pin 9 is the RCLK (Reference Clock) input to the device. This is typically 32.768KHz and is driven from the sleep clock from the base band. When measuring this clock frequency, it may be seen to vary by as much as +/- 120 ~ 200ppm. The device can only typically tolerate +/- 20ppm in order to maintain transmit frequency accuracy. To overcome this, the software driver for the device calculates what the actual sleep clock (RCLK) frequency is and periodically programs the device with this frequency.

The device then internally adjusts its dividers in order to maintain the required output frequency. Using this method it is possible to reduce the effective ppm of the reference clock down to +/- 14ppm over the full operating temperature range of -15 to +50 degrees Centigrade.

General visual inspection guidelines

- If the handset has the FMTx antenna in the back cover then check the condition of the cover, the antenna trace and any mechanical interfaces for the antenna e.g. pogo pins.
- Check that the Si4713 device is placed correctly on the PWB and that there are no obvious signs of damage.
- Check the surrounding components and ensure correct placement on the PWB and that there is no visual damage. Check that there are no missing components.

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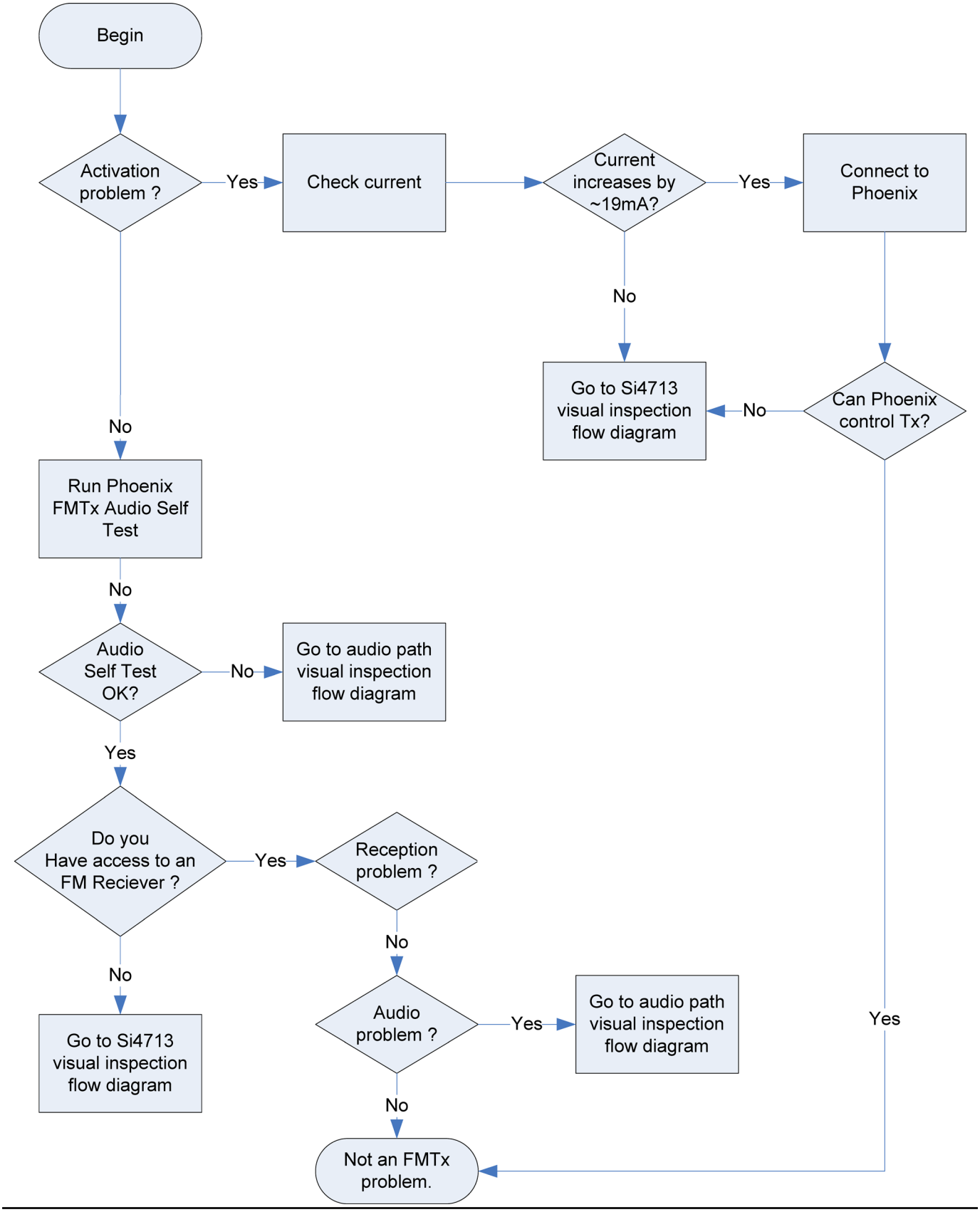
FMTx2.1 troubleshooting

Troubleshooting flow



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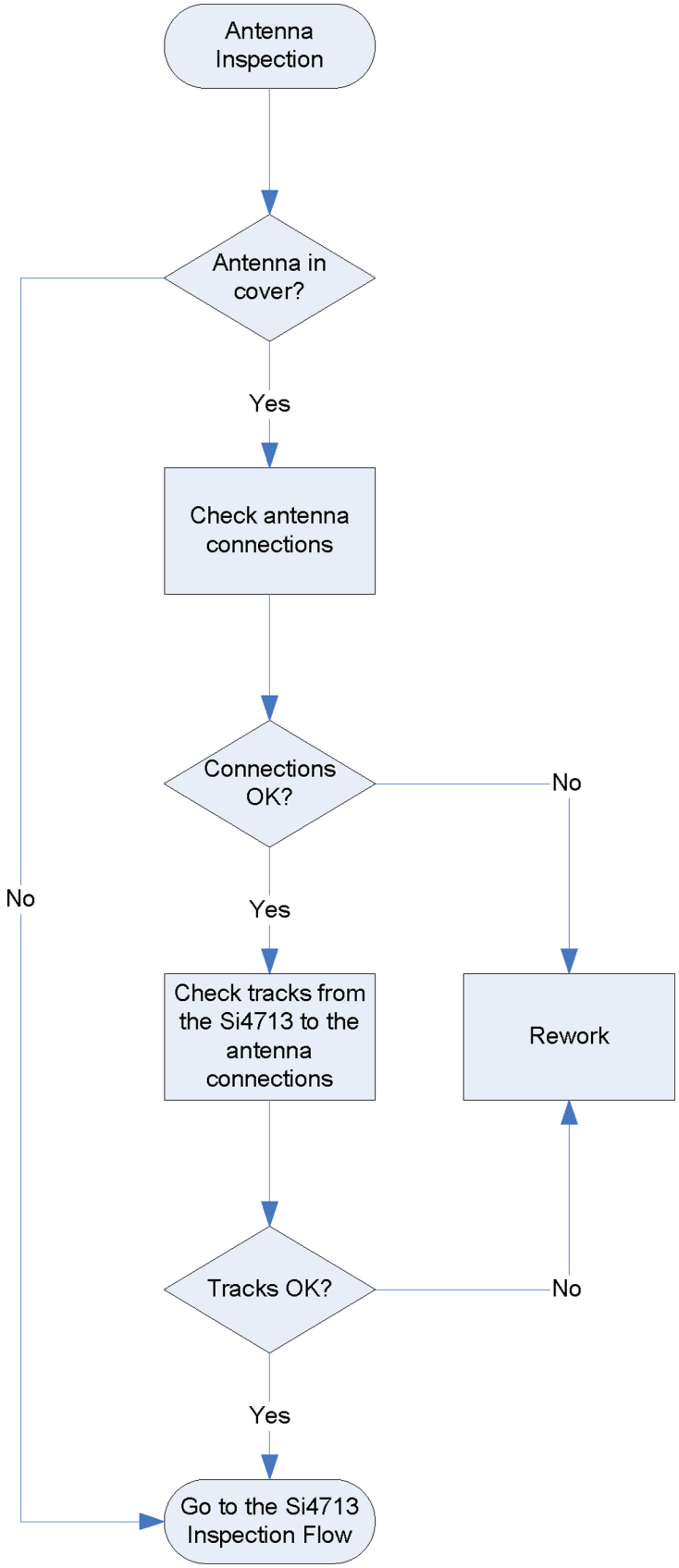
FMTx2.1 antenna visual inspection troubleshooting

Troubleshooting flow



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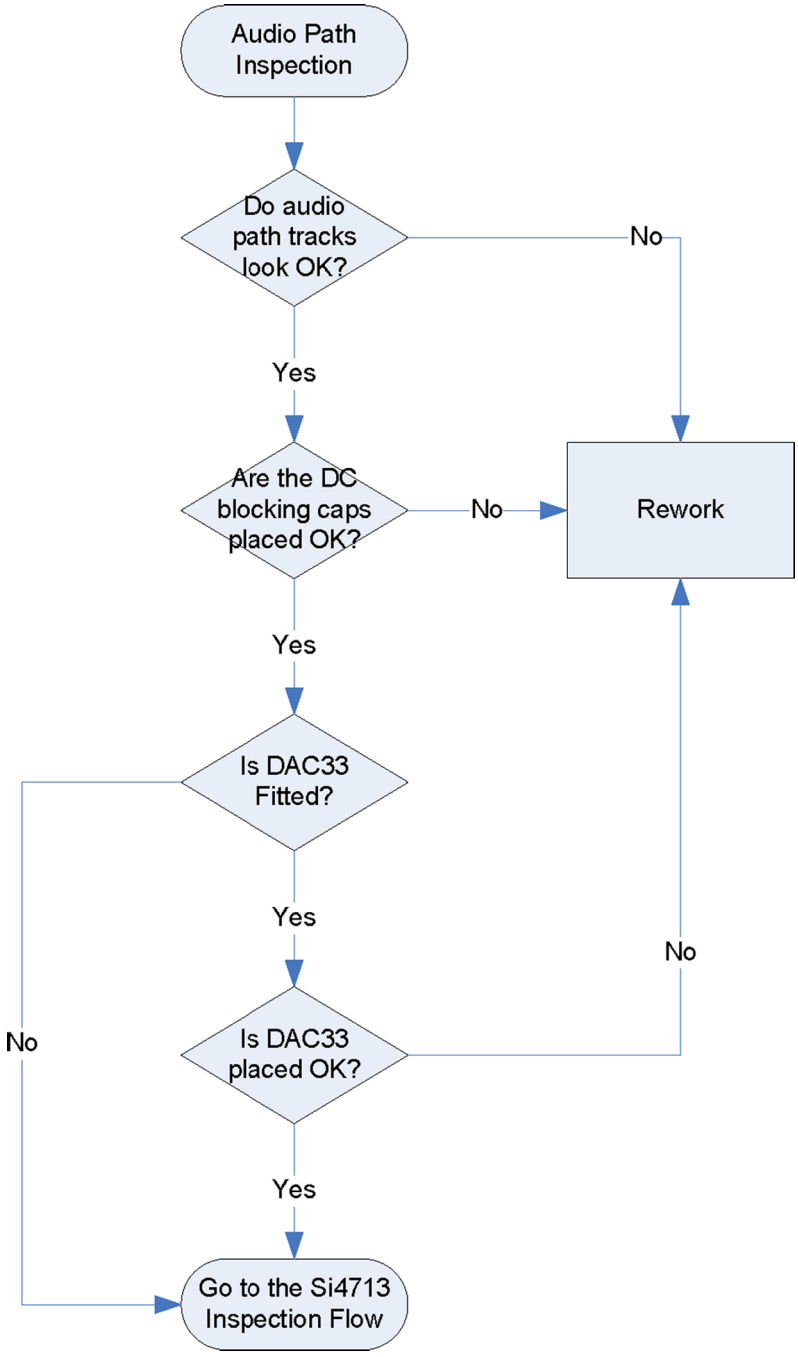
FMTx2.1 audio path visual inspection troubleshooting

Troubleshooting flow



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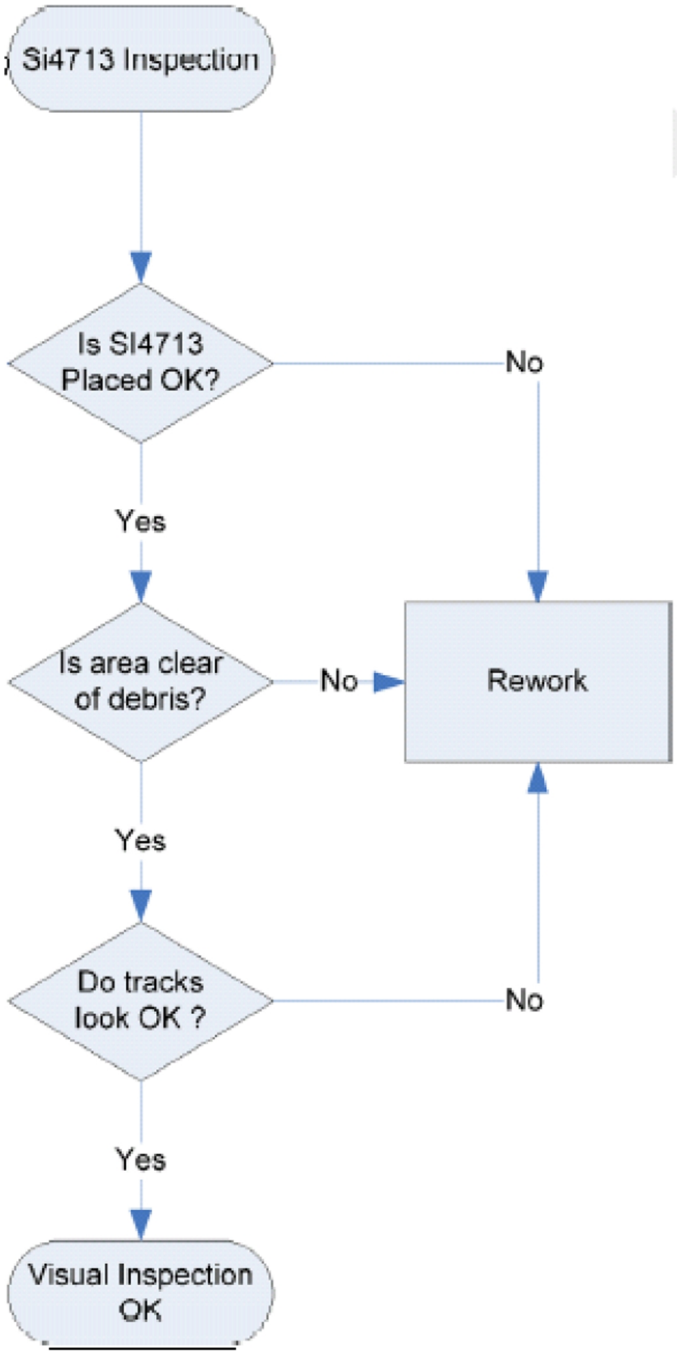
FMTx2.1 Si4713 visual inspection troubleshooting

Troubleshooting flow



Checking validity of signals

Please refer to **Access to signals** figure as a reference. Generally all power supply levels and clocks willbe consistent. Signals on the analogue audio input pins (RIN & LIN – pins 15 and 16 respectively) will be dependant on the audio content being injected to the device. During the audio self test (initiated from Phoenix) it is possible to monitor these pins and check that the DSP generated 1KHz tones can be seen at some point during the test. Check that the signals are clean and that no obvious distortion can be seen such

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as clipping of the signals. Typical maximum swing of these tones will be ~636mV peak to peak. The maximum swing may vary between Nokia handsets but for the FMTx 2.1 implementation, the swing should not be greater than the aforementioned value.

FMTx2.1 troubleshooting faults

Possible faults

Expected fault reports relating to the FMTx 2.1 implementation may consist of one or more of the following;

1 No left audio
2 No right audio
3 No audio
4 Can't start FMTx
5 Can't locate FM transmission on an FM receiver or no FM transmission
6 Distortion on audio
7 Poor reception on FM receiver
8 No RDS information

Initial fault analysis

Where possible, attempt to reproduce and verify the reported fault. Intermittent problems are likely to be due to bad connections or broken components/solder joints. Any faults relating to poor FM transmitter performance or frequent failure to locate usable frequencies when performing a scan are likely to be due to some kind of antenna issues.

In handsets that utilise an antenna solution in a removable cover it is likely that the connecting interface pins are either damaged, dirty or that the cover fits poorly perhaps due to broken tabs/latching lugs. Poor audio fault reports may also be due to the above antenna issues.

Phoenix PC tool

Setting Up Phoenix

Required equipment:

- A Deskey security dongle for Phoenix to run.
- The latest version of Phoenix that has the FMTx 2.1 GUI installed on a PC (version 2007.21.000.27897 or greater).
- A jig suitable for the handset.
- A cable to connect the jig/handset to the PC. Run Phoenix and select the FMTx panel.

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Using the FMTx panel to drive the FMTx 2.1 features

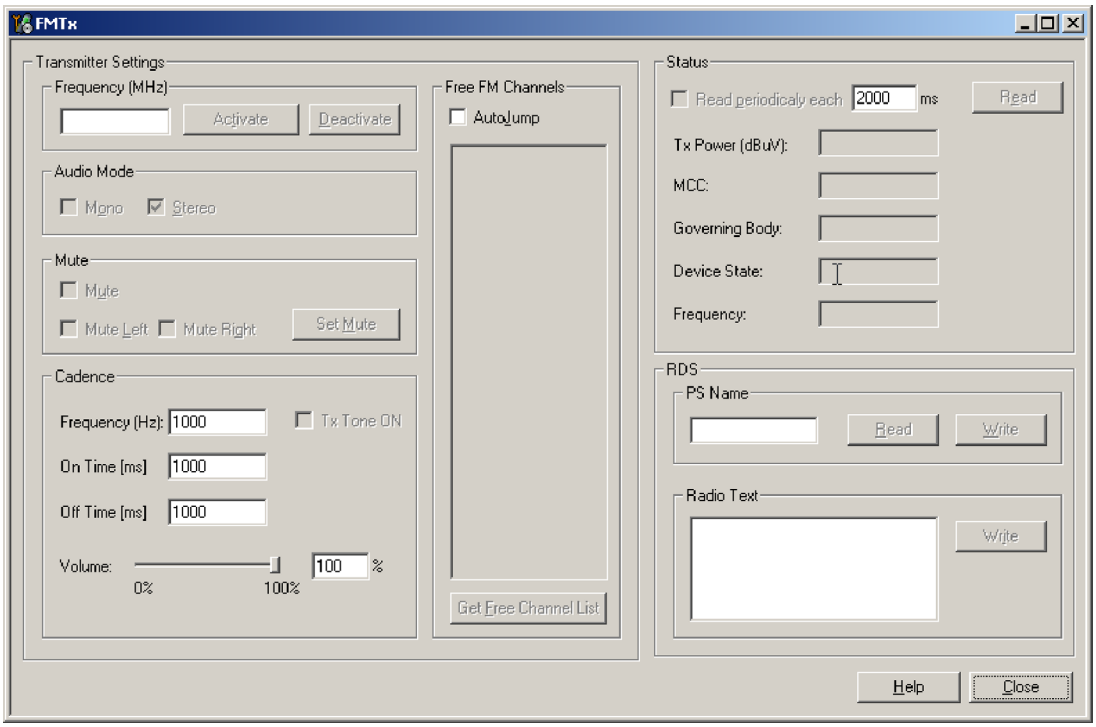

Figure 55 FMTx panel before connection to the handset

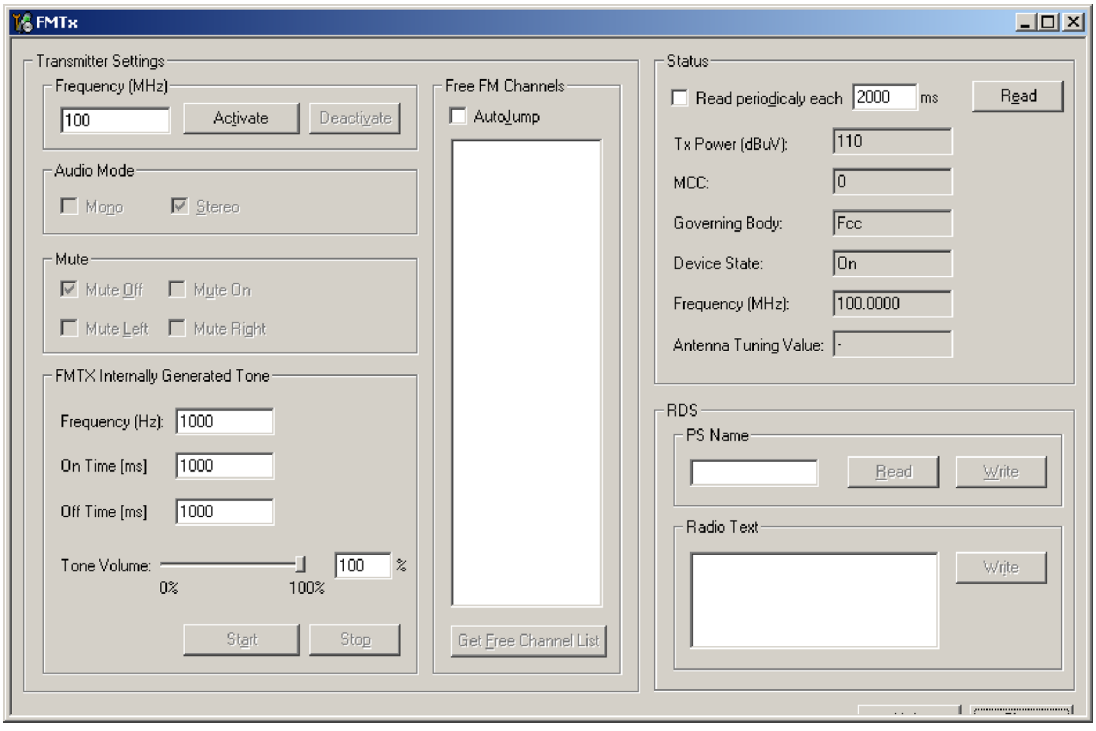

Figure 56 FMTx panel after connection to the handset

Typing in a valid FM transmitter frequency and clicking on 'Activate' will turn on the FMTx feature and will begin transmitting the carrier on the selected frequency. Note: Unless this carrier signal is modulated with some audio (either via the music player or a DSP or Si4713 generated tone) then all that will be heard if an

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FM receiver is tuned to the same frequency would be silence. After approximately 10 seconds of silence the handset should begin to 'chirp' periodically with a short 1Khz tone that repeats every 5 seconds. This indicates that there is no audio input and reminds the user that the feature is on.

The Phoenix FMTx 2.1 panel can be used to control the following features;

- Set the FM frequency to transmit on (88.1 to 107.9MHz).
- Select Stereo or Mono mode (generally all Nokia handsets will only use stereo)
- Mute both left and right audio channels.
- Mute only the left or the right audio channels.
- Allow an internal tone to be generated and transmitted from the Si4713 device. The audio frequency of this tone can be selected along with the on/off time and the volume of the tone. Selecting 0 (zero) in either the on or off time will produce a continuous tone.
- Obtain a list of suitable 'quiet or free' channels. This effectively performs an RSSI (RPS) scan to locate quiet channels to transmit on. If the 'AutoJump' tick box is checked then this list will be transmitted to the FM receiver to allow the handset to perform AF jumps. This is dependent on the Nokia handset and if the FM receiver is RDS capable. The use of AF feature allows an RDS capable FM receiver to follow the transmissions of the FM transmitter automatically.
- FMTx 2.1 status panel. This provides information on the state of the FMTx feature. This can be polled by Phoenix at regular intervals defined by the user when the 'Read periodically each…' check box is checked. The status can otherwise be read at any point by clicking on the 'Read' button. The MCC value is the 'Mobile Country Code' and provided the phone is registered on a network will provide the code pertaining to the country in which it resides. The antenna tuning value is a good indicator of the state of the antenna and the other components connected to the TXO pin. Any value outside of this range will indicate some problem with the components connected to the TXO pin (including the antenna). In the case of a removable antenna, the cause of the out of range value is like to be because of a poor antenna connection. This might be because of broken or dirty connections between the handset and the cover in which the antenna is fitted.
- The RDS panel can be used to set the PS name and/or to enter a Radio Text (RT) string. If access to an FM receiver is available that supports RDS then these strings can be observed on the display of the FM receiver.

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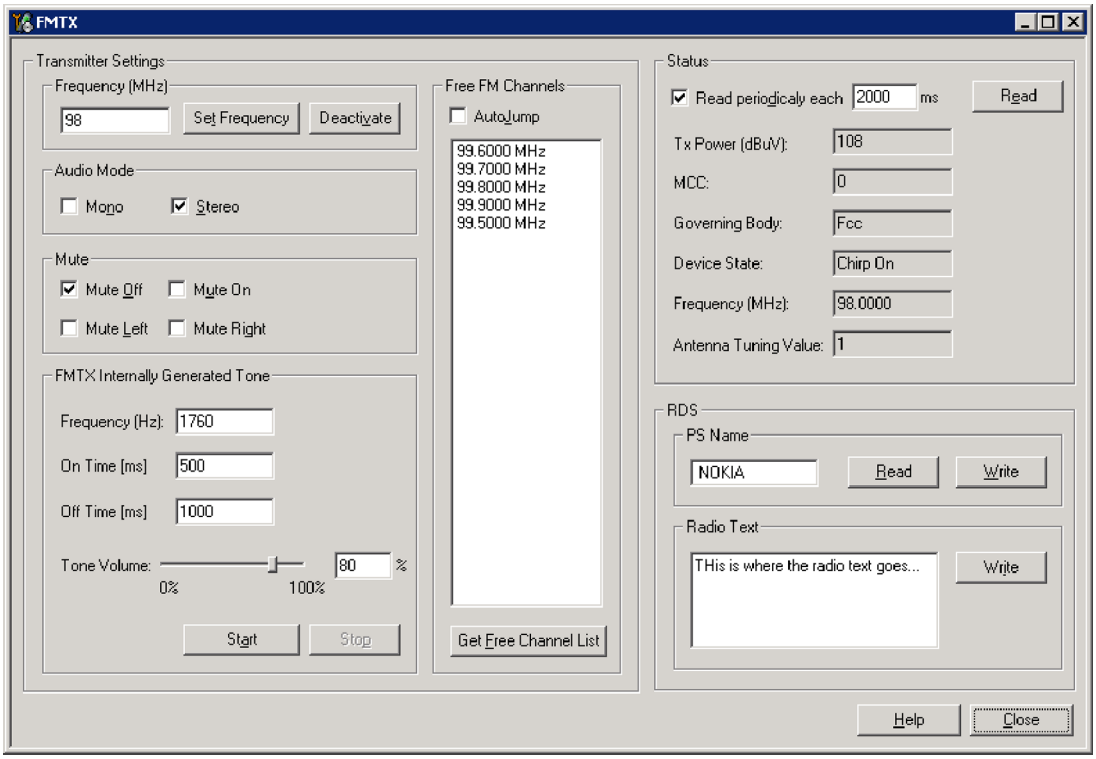

Figure 57 FMTx panel in action

Using the audio self test

The audio self test can be used to quickly determine if the left and right audio paths are intact.

The left and right audio connectivity self test process performs the following steps:

1 Measure and store silence.

2 Inject 1KHz tone (left or right) to give 75KHz deviation. Measure and store.

3 Inject same tone on both left and right analogue audio inputs. Measure and store. Compare result from (2) with result from (1). If the delta is NOT more than a specified threshold level then fail. This would indicate that the selected channel is open circuit. If an over deviation indication is detected on (2), then the audio channels must be shorted together. This is a fail condition. For (3), a returned value of zero is expected. This indicates that there is an over deviation condition which in turn indicates that the 'other' audio input channel is connected correctly.

If on (3) there is no over deviation response, then the 'other' channel must be open circuit at some point in the audio path. This is a fail condition.

The table shows the truth table for the left and right audio self test.

Table 12 Left and right audio self test truth table

LEFT	RIGHT	ASQ Condition	Comment
0	0	0	SILENCE
1	0	0	OPEN/SHORT
1	0	1	OK
1	0	2	SHORT
0	1	X	Don't Care
0	1	X	Don't Care

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LEFT	RIGHT	ASQ Condition	Comment
0	1	X	Don't Care
1	1	0	ALL OPEN/SHORT
1	1	1	OPEN
1	1	2	OK

Using the auto tune panel

The Auto Tune panel should only be used if one or more of the following components have been changed:

- The Si4713 device.
- The Inductor connected to the TX0 pin 4.
- The inline resistor connected to the TX0 pin 4 (if fitted).
- The ESD diode package connected to the TX0 pin 4 (if fitted).

This procedure follows the alignment that is done in the factory to ensure that the FMTx 2.1 solution is aligned to provide the correct Tx output power for the relevant legislations such as FCC and ETSI.

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8 — System Module and User Interface

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Introduction

Phone description

RAPIDOYAWE is the main digital baseband ASIC in the HW53. It contains functionality for both WCDMA and GSM EDGE.

AVILMA is power management ASIC having voltage regulators and audio transceiver and BETTY is energy management ASIC having charging switch and FBUS transceiver.

Memory components are internal COMBO 1 Gb/2 Gb and a card reader for MicroSD.

Function	Description	Item ref
EM ASIC	AVILMAS	N2200
	BETTY	N2300
System ASIC	RAPIDOYAWE	D2800
Memory	Combo 1Gb DDR + 2Gb M3	D3000
Camera accelerator	OMAP-DM500	N1400
Display controller	UPD809400	D6001
Back-up battery	RTC BACKUP CAPAC 3225	G2200
FM-radio with RDS	BTHFMRD2.3 module	D6000
Bluetooth	BTHFMRD2.3 module	D6000
WLAN	WLAN module ENW49701N	N6300
GPS	GPS5350_ROM3.0	N6200
RF ASIC	Vapaus	N7500
GSM PA	850/900/1800/1900	N7520
WCDMA PA	850/900/1900/2100	N7540
Oscillator	VCTCXO 38.4MHZ	G7500
	TCXO 38.4 MHz	G6450
	Crystal 32.768KHZ	B2200
IO-expander	BASIC IOExpander	N2850
SIM card reader		X2700
HS USB transceiver	ISP1707	D3300
FM transmitter	SI4713	N6150
FM transmitter	SI4713	N2101
TV out graphics engine	S1D13771B	D2480
Accelerometer	AHTI_A 3-AXIS	N1100

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System module block diagram

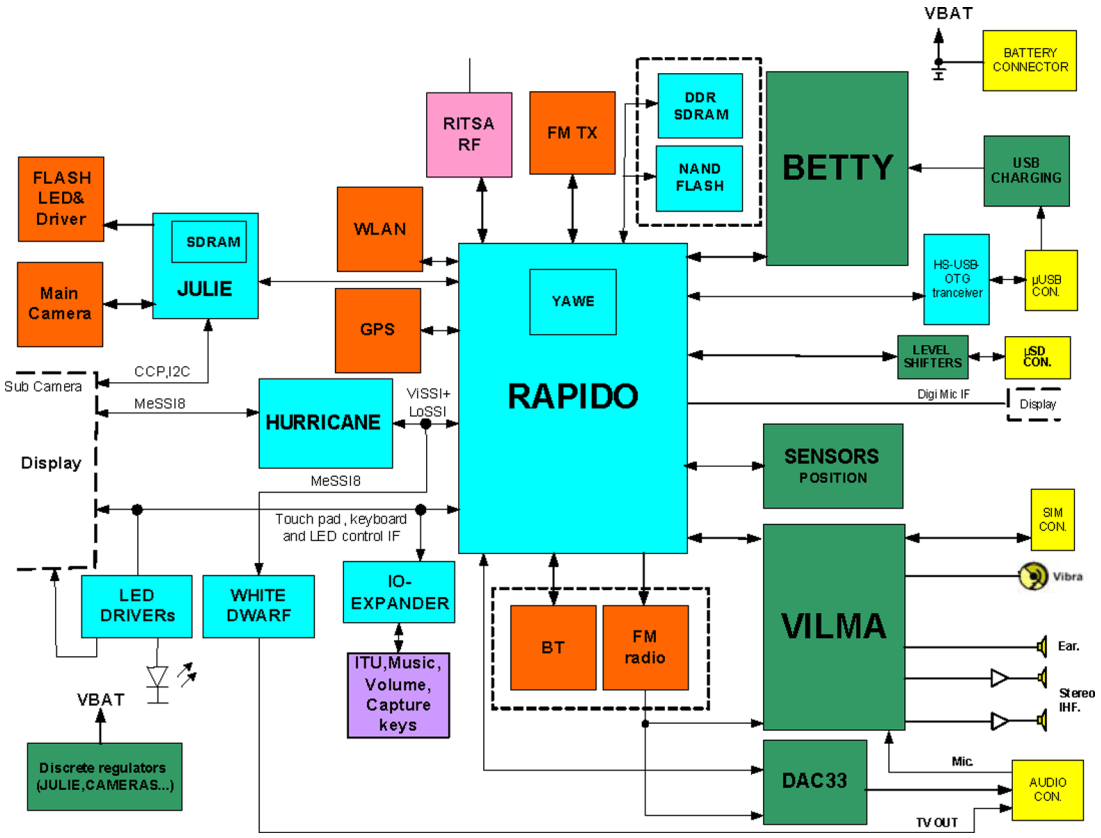

Figure 58 System module block diagram

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Board and module connections

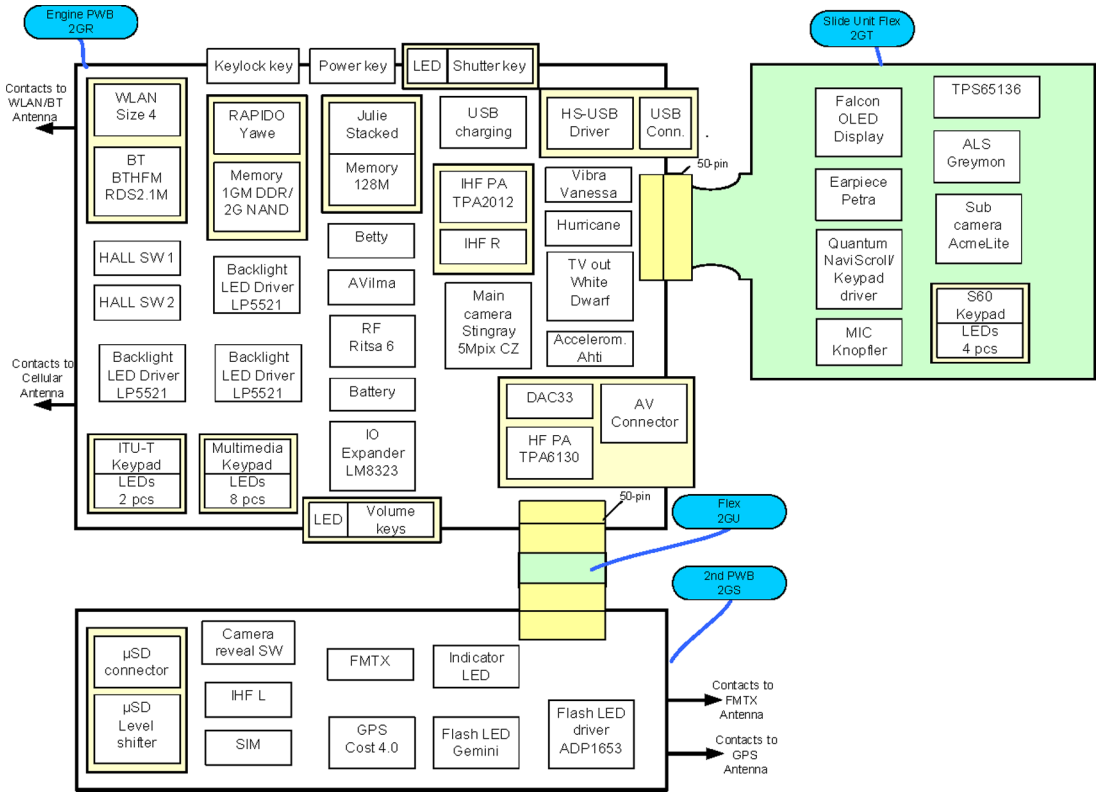

Figure 59 Board and module connections

Energy management

Battery and charging

BP-4L battery

The phone is powered by a 3-pole BP-4L battery S-pack 1500 mAh battery. The three poles are named VBAT, BSI and GND where the BSI line is used to recognize the battery capacity. This is done by means of an internal battery pull down resistor.

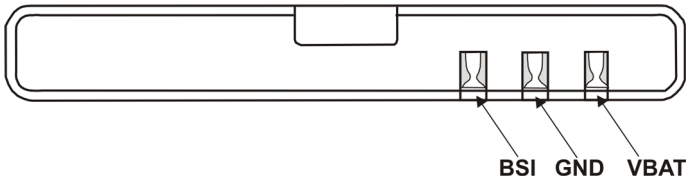

Figure 60 Battery pin order

The battery temperature is estimated by measuring separate battery temperature NTC via the BTEMP line. This is located on the main PWB, at the place where the phone temperature is closest to the battery temperature.

Battery connector

The battery connector is a blade connector. It has three blades;

- BSI (Battery size indicator)
- GND (Ground)

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- VBAT (Battery voltage)

Figure 61 Blade battery connector

Charging

This phone is charged through the micro USB connector. The phone supports dedicated, host or hub chargers.

Charging is controlled by energy management, and external components are needed to protect the baseband module against EMC, reverse polarity and transient frequency deviation.

Backup battery

When the main battery is not attached EM ASIC (N2200) goes in backup mode using back-up battery that supplies voltage to RTC in EM ASIC (N2200).

Normal and extreme voltages

Energy management is mainly carried out in the two Application Specific Integrated Circuits (ASICs) BETTY and AVILMA. These two circuits contains a number of regulators. In addition there are some external regulators too.

In the table below normal and extreme voltages are shown when a BP-4L battery is used.

Table 13 Nominal voltages

Voltage	Voltage [V]	Condition
General Conditions		
Nominal voltage	3.700	
Lower extreme voltage	3.145	
Higher extreme voltage (fast charging)	4.230	
HW Shutdown Voltages		
Vmstr+	2.1 ± 0.1	Off to on
Vmstr-	1.9 ± 0.1	On to off
SW Shutdown Voltages		
Sw shutdown	3.15	In call
Sw shutdown	3.3	In idle
Min Operating Voltage		
Vcoff+	2.9 ± 0.1	Off to on
Vcoff-	2.6 ± 0.1	On to off

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Battery drains fast troubleshooting

Table 14 Average current consumption

Use case	Current consumption
Video call	540mA
Video streaming HSDPA QVGA Mpeg4 30fps BT hs	510mA
Video recording 640x352 30fps	400mA
Video playback 640x352 30fps	340mA
WCDMA voice call	250mA

Power key and system power-up

When the battery is placed in the phone the power key circuits are energized. When the power key is pressed, the system boots up (if an adequate battery voltage is present).

Power down can be initiated by pressing the power key again (the system is powered down with the aid of SW). The power key is connected to EM ASIC N2200 (AVILMA) via PWRONX signal.

The power key may be disabled in certain charging cases.

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Power distribution

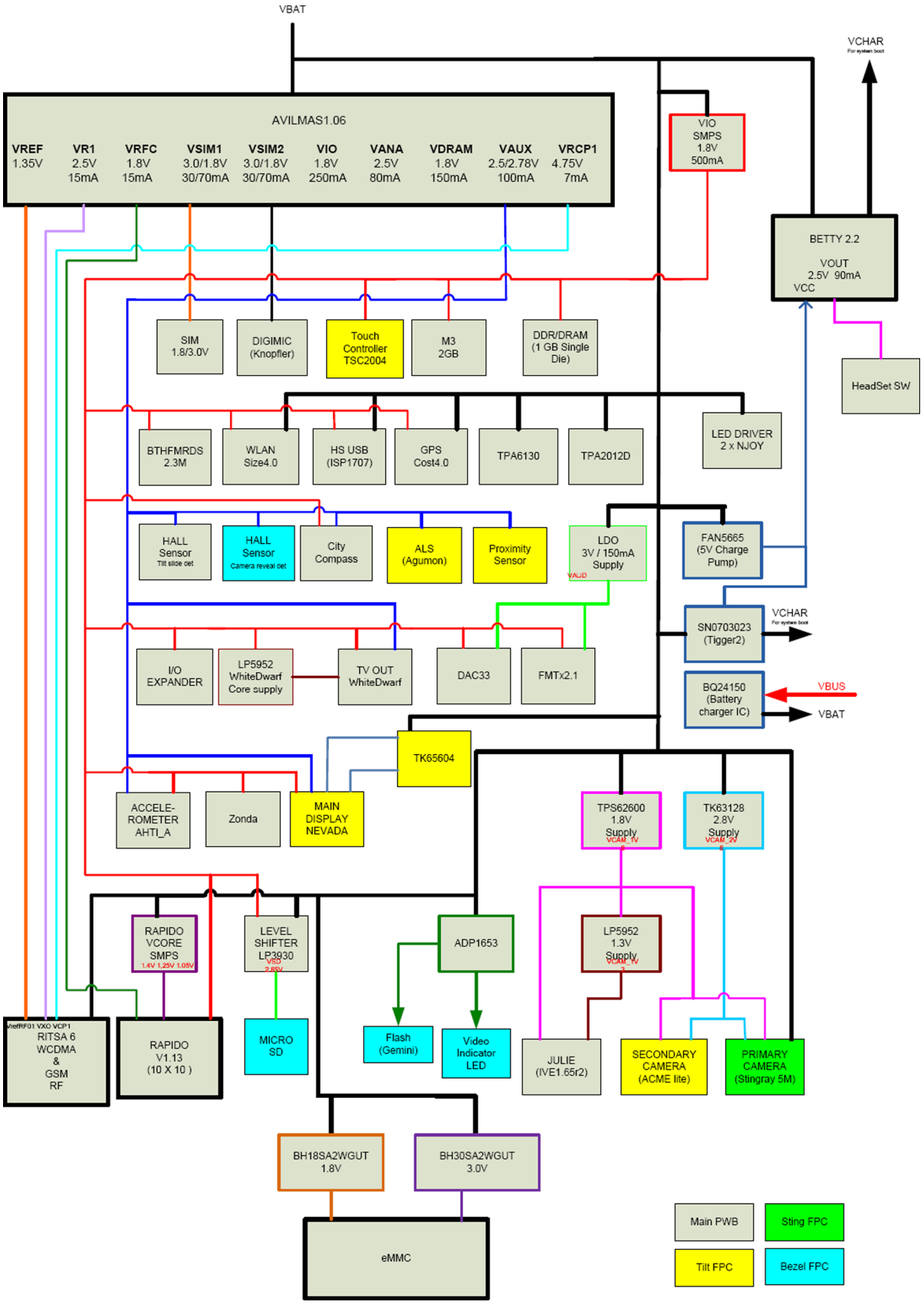

Figure 62 Power distribution

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Clocking scheme

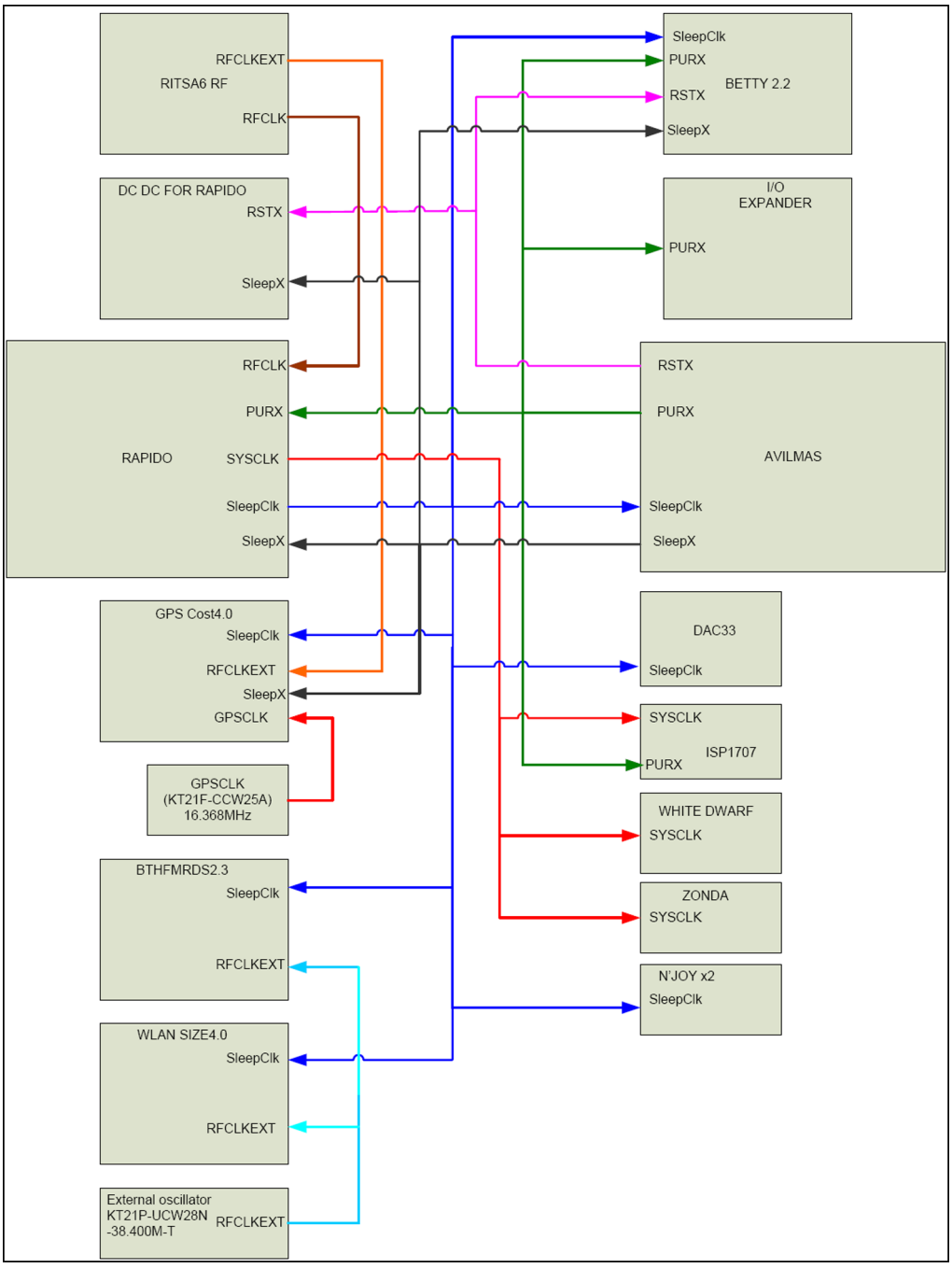

Figure 63 Clocking scheme

Ivalo engine clocks	
RFCLK	38.4 MHz
SleepClk	32.768kHz
RFCLKEXT	38.4 MHz
SYSCLK	19.2 MHz

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Bluetooth and FM RDS radio module

Bluetooth and FM radio receiver are provided by the same ASIC (Broadcom BCM2048). The device supports Bluetooth operation and FM radio rececption in both European/USA and Japanese bands (the appropriate region-specific FM radio band is pre-configured in the phone software). The UART interface allows the device to communicate with the phone baseband engine using Bluetooth HCI commands. Commands to the FM radio can also be sent over the I2C interface.

When Bluetooth is switched on, the phone user interface the BT_RESETX line is toggled to reset the Bluetooth device, and commands are sent over the UART interface to configure the device. If UART communication fails (due to a hardware fault) it will not be possible to switch on Bluetooth from the phone user interface.

The device has two clock signals: SYS_CLK (19.2MHz, 26.0MHz, or 38.4MHz supported) and SLEEP_CLK (32.768kHz). The SLEEP_CLK is supplied all the time the phone is switched on. To maximise the phone standby time, it is only necessary to provide a SYS_CLK signal when Bluetooth activity occurs, such as sending Bluetooth data to another device, or checking periodically if there are any other Bluetooth devices attempting to communicate with it. At other times when the Bluetooth device is in standby mode or the FM radio is switched on it is only necessary to provide a SLEEP_CLK signal. The Bluetooth-FM ASIC is powered directly from the phone battery voltage line (VBAT). An internal regulator is enabled when Bluetooth or FM radio is switched on.

Bluetooth audio signals are sent to and from the device using a PCM interface. The Bluetooth RF signal is routed via a buried track to the Bluetooth antenna on the side of the PWB. An RF filter is needed between the Bluetooth antenna and Bluetooth ASIC to prevent interference to and from the celluar phone antenna. Phones that have both Bluetooth and WLAN use a shared antenna, as both services occupy the 2.4GHz ISM frequency band. The co-existence signaling interface between Bluetooth and WLAN ASICs controls the RF activity in the shared frequency band.

The audio signal from the FM radio is routed via the phone Audio ASIC to the phone headset or loudspeaker. The external wired headset is also used as an Antenna for the FM radio. The FM radio receiver RF signal is routed from the ASIC via a buried track to an impedance matching circuit placed near the headset connector.

The following block diagram shows how Bluetooth-FM is connected to the host engine.

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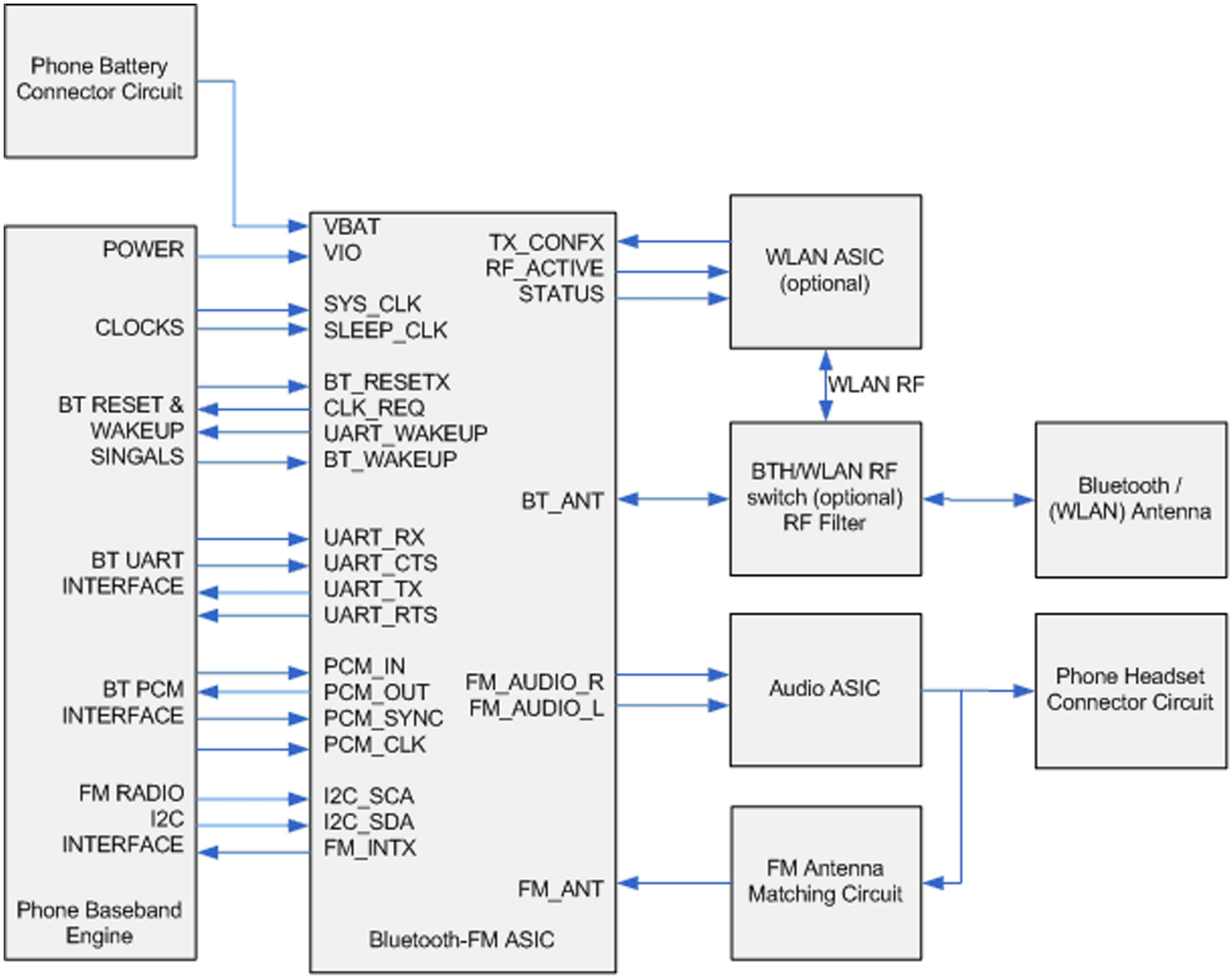

Figure 64 Bluetooth & FM radio block diagram

I/O Expander

I/O Expander is used for control signals that are not time critical, such as for keyboard inputs, enable & reset signals etc. It is connected to the I2C bus, and has its own interrupt. PURX is used as I/O Expander's reset. I/O Expander is powered from VIO 1.8V.

This device does not have a keyboard matrix, due to the minimal amount of keys needed in the touch input concept. Instead, keys are connected as SF keys. This means that the keys connect each row to the ground.

Two control signals are controlled by the I/O Expander, TV-out reset signal and AVVideoCtrl. AVVideoCtrl is used for two tasks: enabling TV out core regulator, and driving the switch that routes the TV out signal to the signature connector.

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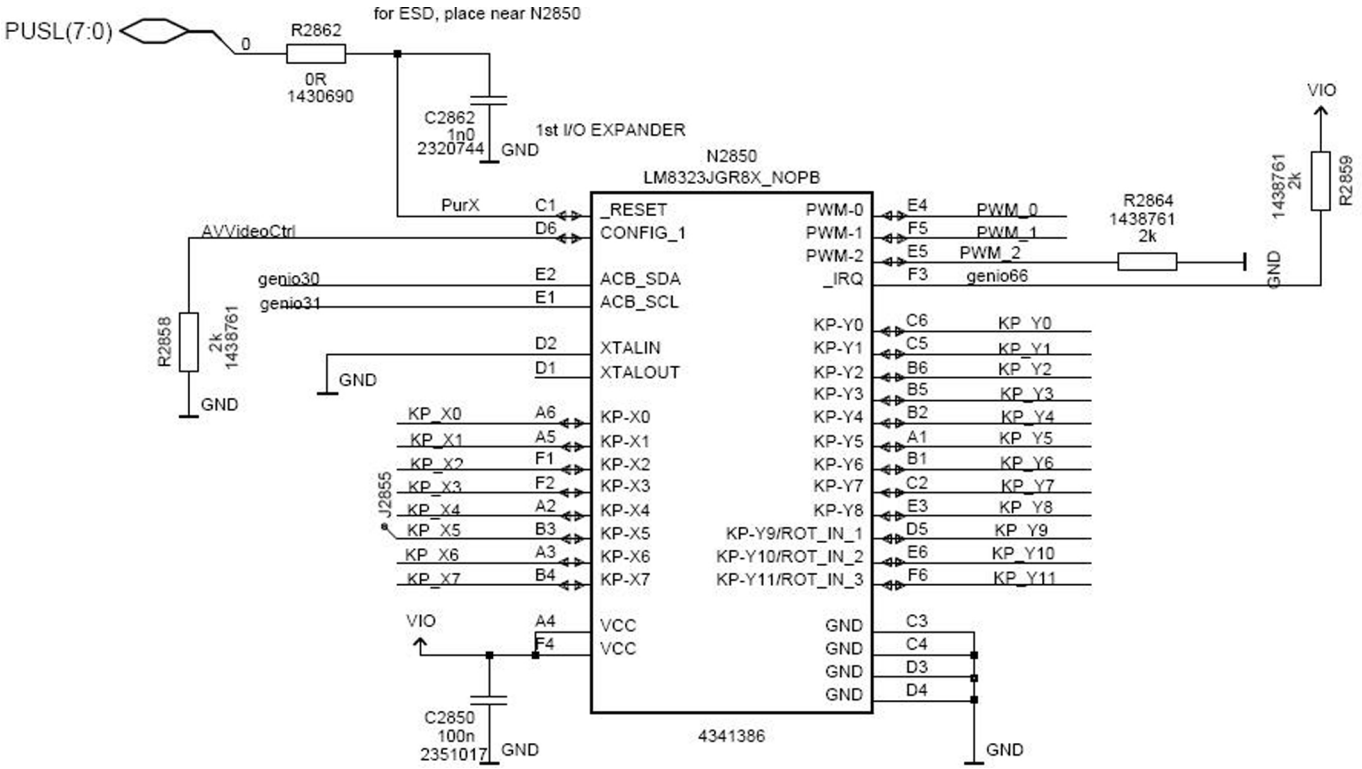

GPS interface

Functional description

The device includes an inbuilt GPS receiver and it works as a stand-alone positioning device.

The GPS solution provides a full GPS HW and SW engine for devices capable of operation in all GPS modes:

- Autonomous (standalone) - no communication with network is required for GPS fix
- MS based - the device receives aiding information from the network and computes fix internally
- MS assisted - the device receives aiding information from the network and computes pseudorange measurements. The measurements are then sent back to the network for the fix calculation.

At the heart of the GPS solution is GPS5350 GPS receiver IC, which has GPS RF receiver and GPS BB processor integrated into a single IC. RF section performs down conversion, filtering and IF sampling, whereas BB section contains an enhanced version of multimode GPS with twelve hardware matched filters, post detection logic and an ARM controller core.

The features of the GPS solution include:

- 12 channels
- Integrated regulators for RF and BB (including external LNA)
- Direct connection to a battery
- Fast clock calibration through availability of 261MHz clock from RF PLL
- Improved tracking and Hot start (TTFF) reacquisition performance
- Advanced Power Management and Host Wakeup capability.

The I2C interface handles data transfer between GPS and the Rapido. GPS uses the CE RF system clock to calibrate its own GPS Clk.

GPS has three clock sources:

- 16.368MHz clock from a dedicated TCXO (G6200)

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- 38.4MHz reference clock from Ahneus RF ASIC
- 32.768kHz Sleepclk

The GPS module is powered from VIO 1.8V and VBAT.

Block diagram

The following block diagram shows how the GPS module is connected to the host side.

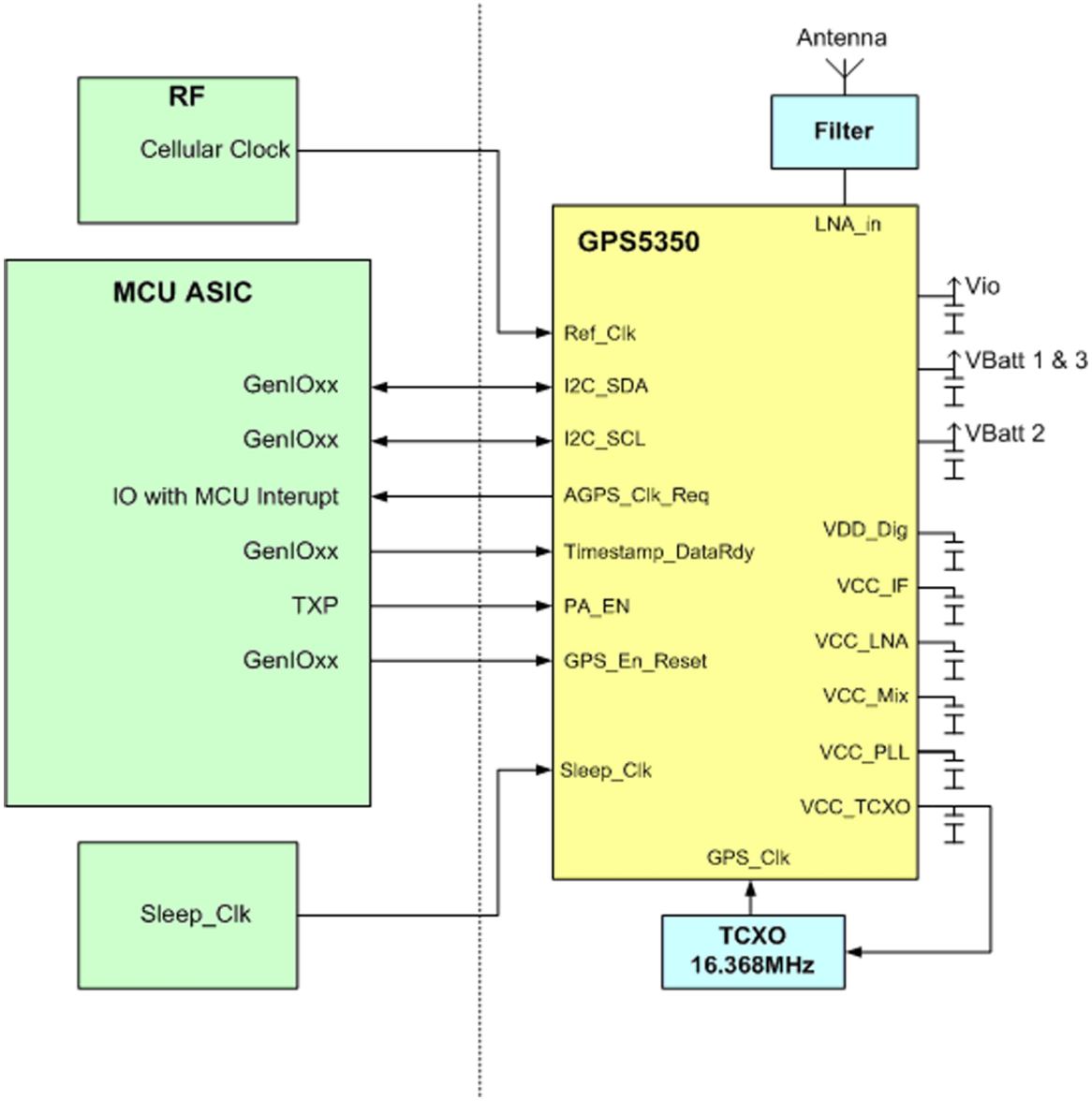

Figure 65 Block diagram of the GPS system

Interface signals

Signal name	I/O	Function
RF		
ANT_GPS	I	GPS antenna port
LNA_In	I	GPS ASIC RF input
Clocking		

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Signal name	I/O	Function
REF_CLK	I	Reference Clock = RF Cellular clock, Min 0.2V_{pk-pk}
GPS_CLK	I	Connection of 16.368MHz GPS TCXO
RTC_CLK	I	Cellular engine 32768 Hz sleep clock
Control		
GPS_EN_RESET	I	GPS engine reset
AGPS_CLK_REQ	O	MCU Interrupt when GPS requires CE to be awake (Host Wakeup)
IO_TIMESTAMP_DATARDY	I	Strobe for accurately marking in real time, timing information from the cellular engine. DATARDY indication to download code through synchronous operation from cellular engine.
IO_PA_EN	I	Used to implement PA blanking when cellular PA is ON
Comms		
I2C_SCL_U1TX	B	I2C clk line
I2C_SDA_U1RX	B	I2C data line
Power		
VDDS	P	Cellular engine I/O supply
VBatt 1 & 3	P	Phone battery power or SMPS power
VBatt 2	P	Phone battery power
VSS	P	Ground plane

WLAN module

WLAN module HW53 supports WLANSize4.0 release. WLAN module is configured as Cellular engine SPI slave. WLAN and Bluetooth co-existence is supported via BTH-WLAN interface. WLANSize4.0 has a reference clock of external oscillator 38.4MHz and it is shared with BTHFMRDS2.3

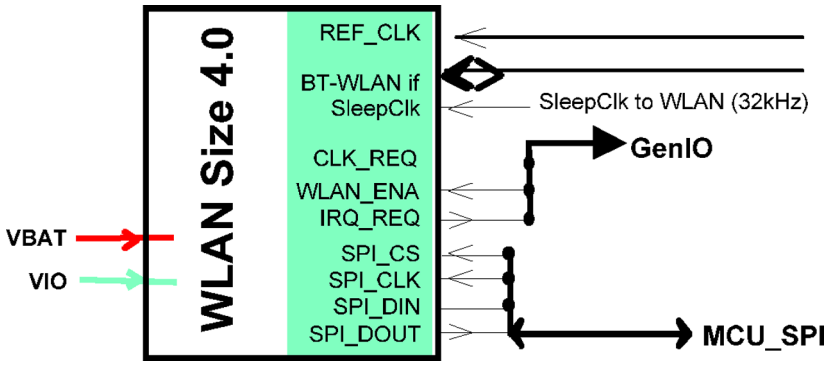

Figure 66 WLAN module

FM transmitter module

The FM transmitter module Si4713 is controlled by I2C from RAPIDO with left and right analog audio input from the DAC33.

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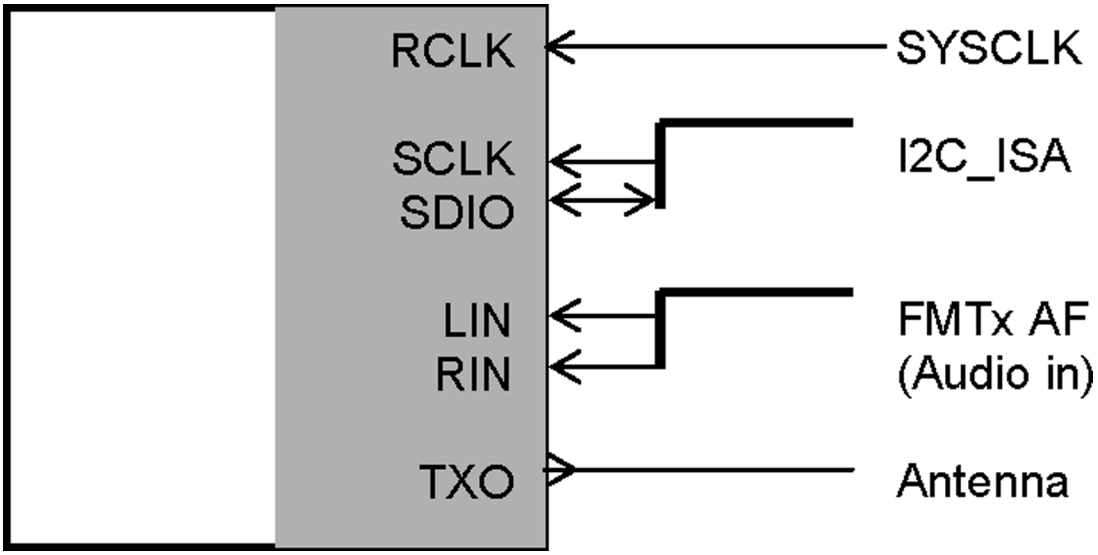

Figure 67 FM transmitter

High-speed USB

High-speed USB

The device can transmit and receive USB data at high-speed (480 Mbit/s), full-speed (12 Mbit/s) and low-speed (1.5Mbit/s). The external interface is the micro-B connector X3300. The interface between D3300 USB transceiver and micro-B receptacle is the standard USB interface specified in the Universal Serial Bus specification Rev. 2.0. The USB transfers signal and power over four-wire interface, which carries differential data, Vbus and GND. Signalling occurs over differential data line D+ and D-. The clock is transmitted encoded along with the differential data. ESD protection is done with USB ASIP Z3300. VBUS (+5V) is provided by the host device. The circuit is protected from an overvoltage condition by transistor pair V3300 and reference zenner diode V3301.

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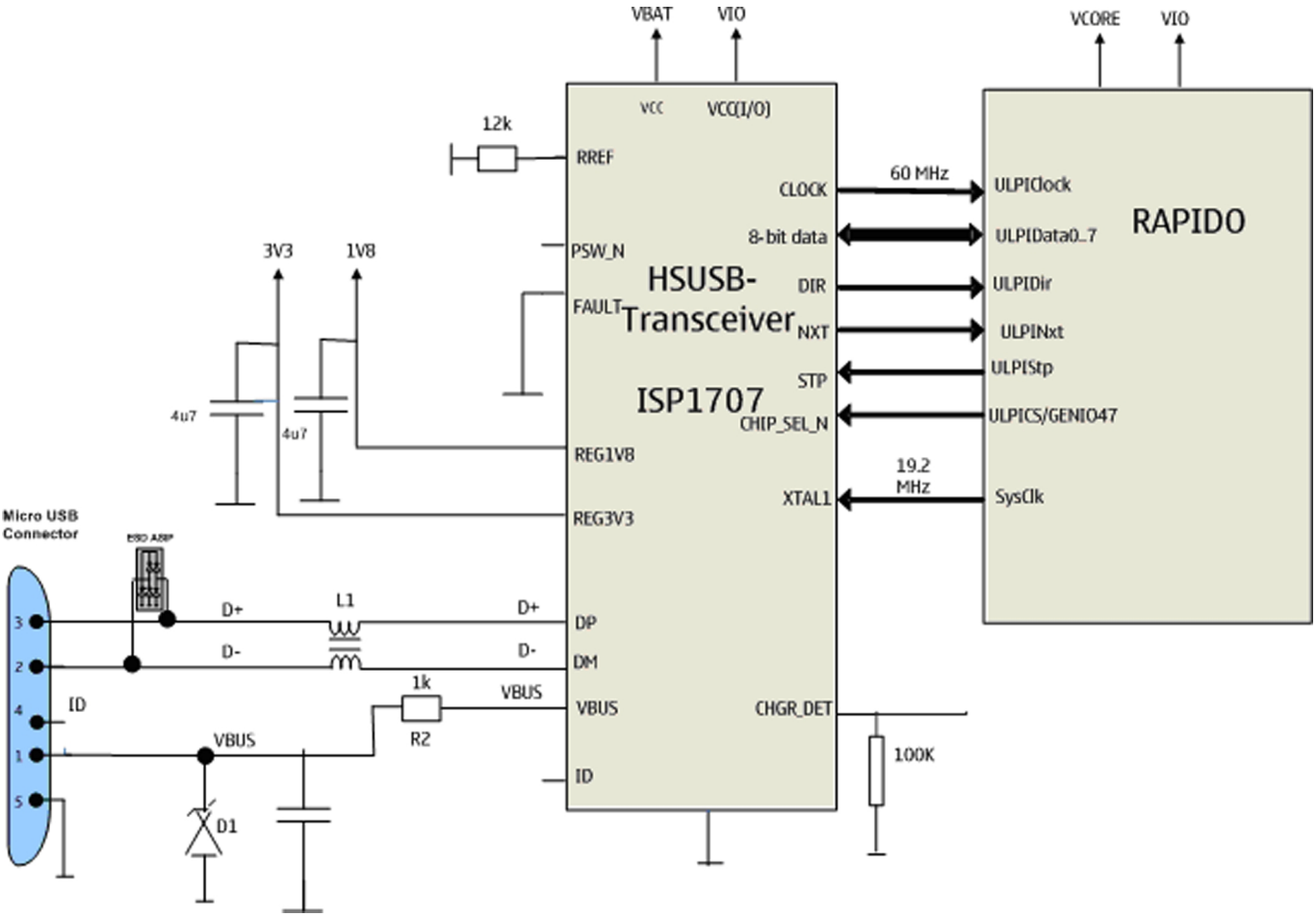

Figure 68 HS USB block diagram

CBUS interface

CBUS is a main system control bus in BB5. RAPIDO controls the functionality of EM ASICs AVilma (N2200) and Betty (N2300) with CBUS.

CBUS is a four-wire half-duplex master-slave interface. In HW52 CBUS clock frequency is 4.39 MHz.

FBUS interface

FBUS is a 2-wire serial communication bus between HW52 engine and service SW.

ECI interface

The ECI (Enhancement Control Interface) is a point-to-point, bi-directional, single line serial bus.

The purpose of the ECI is to identify and authenticate the accessory, and to act as a data bus (intended for control purposes) between the phone and the accessory .

USB charger interface

The main battery can be charged from the USB port. Default charging current level is 80 – 100 mA during the initial charging. Primary charging current level is up to 500 mA from USB Host and up to 1.25A from USB wall charger with external switch-mode USB Charger BQ24150.

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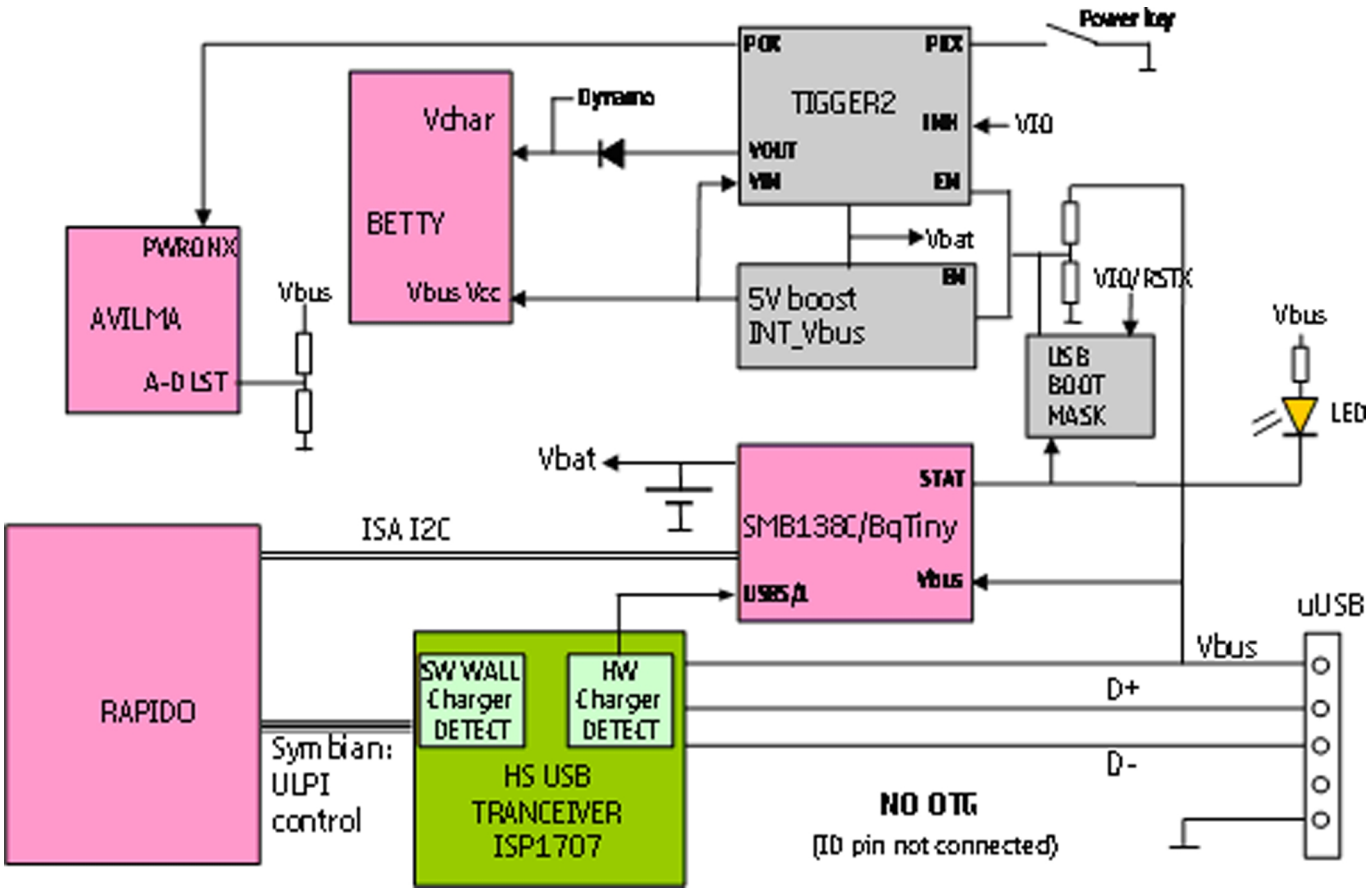

Figure 69 USB charger interface block diagram

SIM interface

The device has one SIM (Subscriber Identification Module) interface. It is only accessible if battery is removed. The SIM interface consists of an internal interface between RAPIDO and EM ASIC (N2200), and of an external interface between N2200 and SIM contacts.

The SIM IF is shown in the following figure:

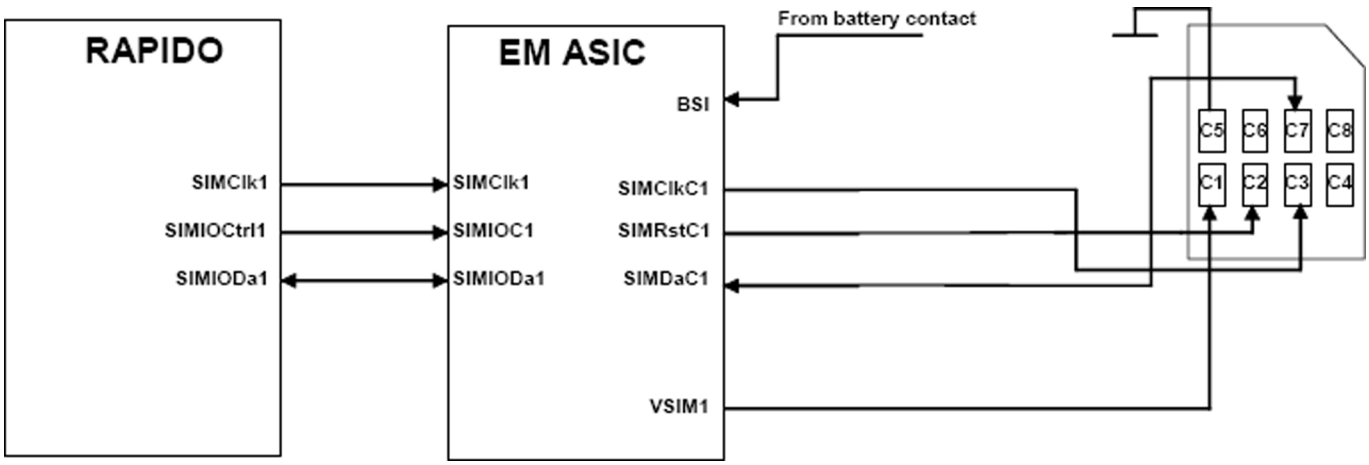

Figure 70 SIM interface

The EM ASIC handles the detection of the SIM card. The detection method is based in the BSI line. Because of the location of the SIM card, removing the battery causes a quick power down of the SIM IF.

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The EM ASIC SIM1 interface supports both 1.8 V and 3.0 V SIM cards. The SIM interface voltage is first 1.8 V when the SIM card is inserted, and if the card does not response to the ATR a 3 V interface voltage is used.

MicroSD card interface

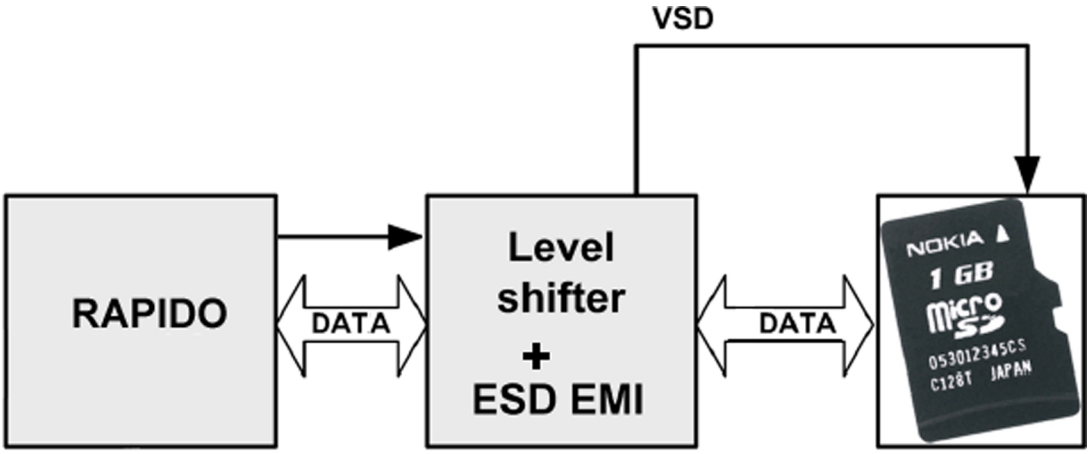

Figure 71 MicroSD card interface

The MicroSD card is connected to the engine by an external level shifter with an ESD protection filter. Supplied voltages:

- VSD: 2.85 V (from level shifter)
- VIO: 1.8 V (from VIO SMPS)

Hot swap is supported, which means that the card may be plugged in/out at any time, without removing the battery.

Camera concept

Camera concept

Camera subsystem concept

Key Components

Powering

Block diagram

The camera subsystem contains the complete imaging system for the main 5Mpixel camera. The main features of the Imaging and video baseband subsystem are

- Hardware acceleration for the Image processing
- Support for 5MPixel Main camera
- Support for secondary VGA camera module
- Support for Flash LEDs and its driver from ADI
- **DM5001D processor**

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Imaging Video baseband is implemented using DM5001D processor. DM5001D processor is a hardware accelerator for Imaging and Video application. This processor controls all the cameras and flashes in the system.

This processor is controlled by Rapido processors via SPI interface. Boot code is downloaded into DM5001D Internal memory via the SPI interface at power on. Further application code (self-test, image capture, video capture) is transferred depending on the usage case.

Video and still image data is passed to the Rapido for display and storage after processing over a CCP bus (CCP_CMT).

- **Primary Camera module (5 Mpixel Camera)**

  The camera module is SMIA95 compliant and is configured by the DM5001D using I2C control bus. Image data is transferred to the DM5001D over a CCP balanced bus (HIRES_CCP)

- **Secondary VGA Camera module**

  The camera module is electrically SMIA compliant module (not mechanically) and is configured by the DM5001D using I2C control bus. Image data is transferred to the DM5001D over a CCP balanced bus (LORES_CCP)

- **Flash LED**

  The camera flash LED is controlled from the DM5001D via the ADP1653 driver. Driver has GPIO control for STROBE/ENABLE and I2C bus control for configuring.

The camera subsystem is powered from 1.3V, 1.8V and 2.8V discrete regulators. The 1.3V regulator is powerd from 1.8V regulator. The 1.8V and 2.8V regulators are powerd from VBAT. The LED driver is powered directly from the VBAT supply. These supplies are turned off/on by the host processor using the GPIO (Julie_REG_EN), depending on the camera usage.

The high-level camera subsystem block diagram is presented in the following figure:

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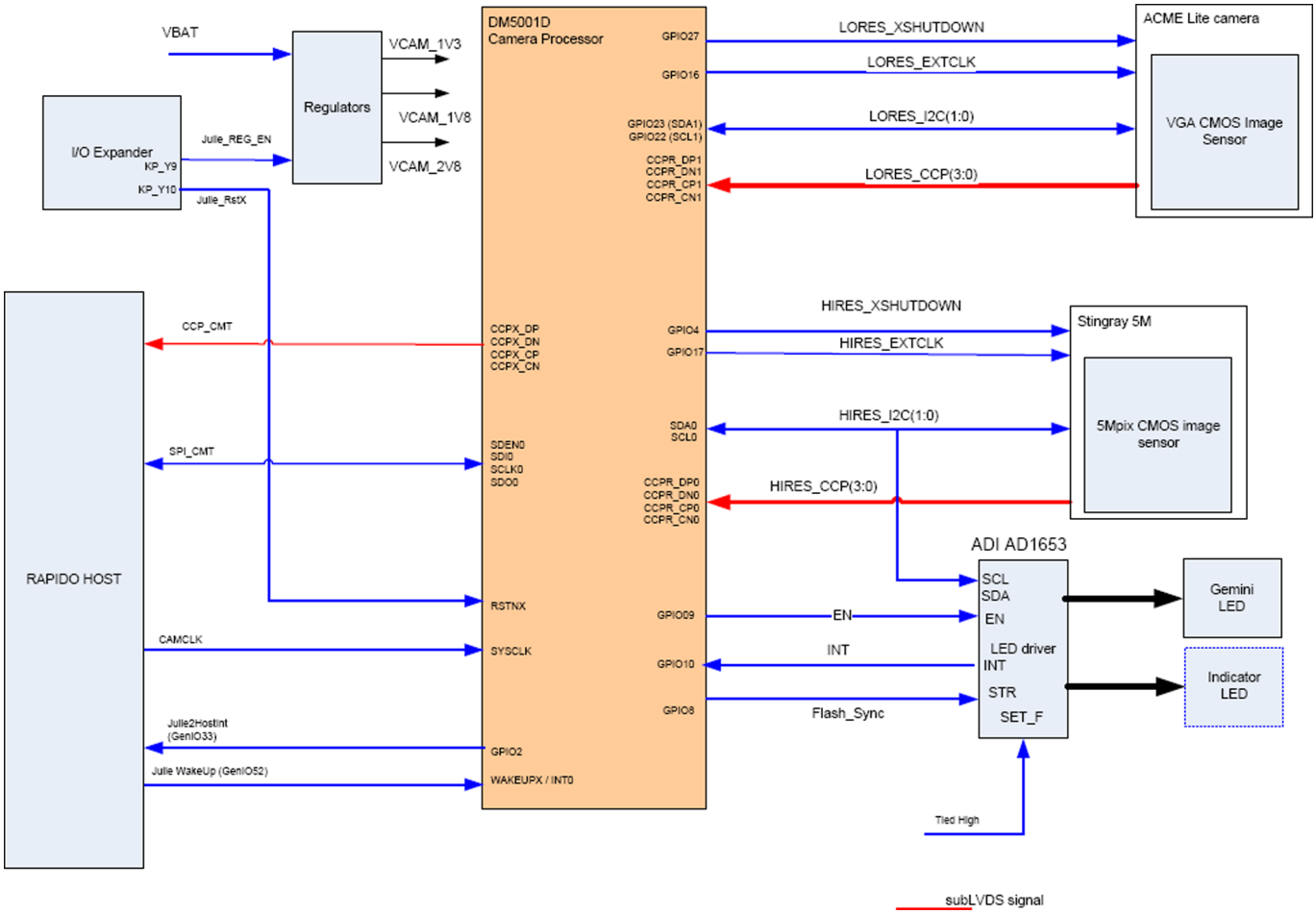

Figure 72 Camera subsystem block diagram

User interface

Resistive touch screen

Proximity sensor

The proximity sensor is used to turn off the touch input, when the phone is against user's ear during call. This prevents accidental touch signals that could happen when, for example, user's cheek touches the phone.

The main parts of the proximity sensor subsystem are:

- Proximity sensor
- Proximity boot (mechanical part)

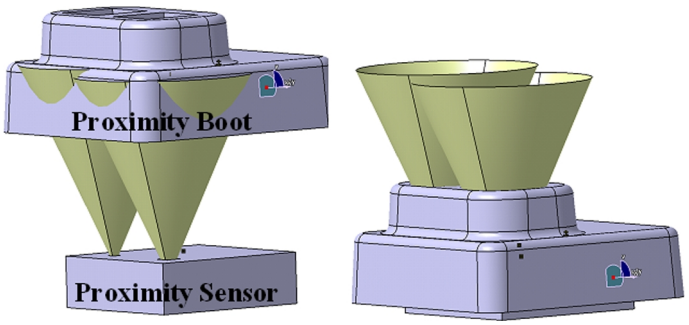

Figure 73 Proximity sensor and boot

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The proximity sensor is located on the upper flex assembly.

Features

The Proximity sensor has following features:

- 2.8V
- 1.8V compatible IOs
- Low power consumption
- 20 mm working area
- Factory calibrated, no calibration required in care
- Pb free/RoHS compliancy

The proximity sensor works by sending out a beam of IR light, and then computing the distance to any nearby objects from characteristics of the returned (reflected) signal. When the object is under 20 mm distance detection will happen and output will go to high state (1.8V).

Reference design

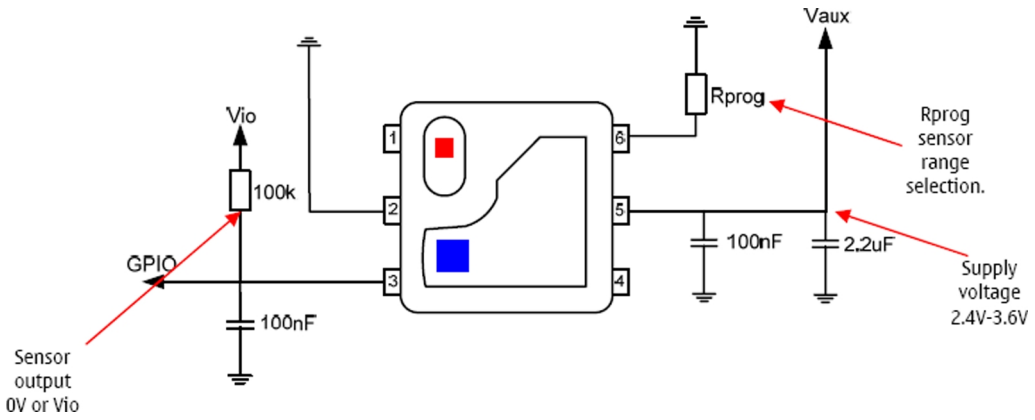

Figure 74 Proximity sensor reference design and measurement points

Pin	Signal name	Description
1	Anode LED	No connection
2	GND	Ground
3	OUT	Sensor output (0V or 1.8V Push-Pull)
4	TEST	No connection
5	VCC	Supply voltage (2.4V - 2.8V)
6	Rprog	Program resistor

Touch screen controller

TSC2004 (N500 on Tilt FPC) is a touch screen controller for resistive touch pads. It contains a complete ultralow-power, 12-bit, analog-to-digital (A/D) resistive touch screen converter, including drivers and control logic to measure touch pressure.

It also has embedded pre-processing function to reduce the output bus load. The host interface in TSC2004 is I2C.

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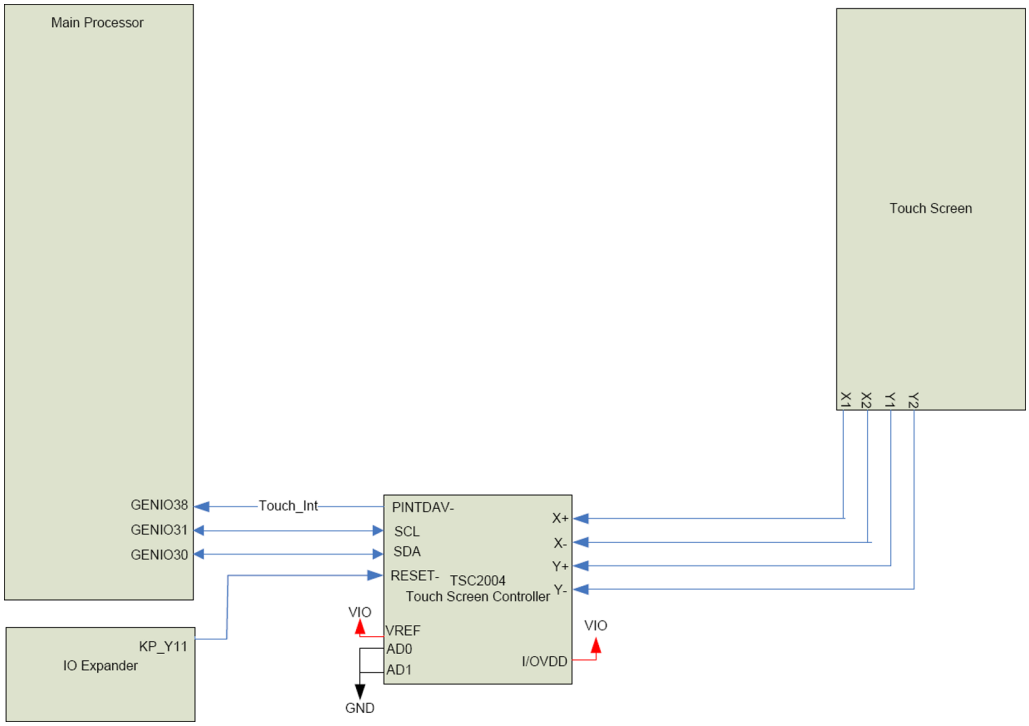

Figure 75 Touch screen controller

Display

Display

Rapido has an external display buffer with 8Mbit display RAM. The input interfaces for display buffer are ViSSI-12 for image data and LoSSI for commands.

The data interface between display buffer and display is CDP (Compact Display Port), display commands are sent by LoSSI interface. The display backlight control is controlled by the display.

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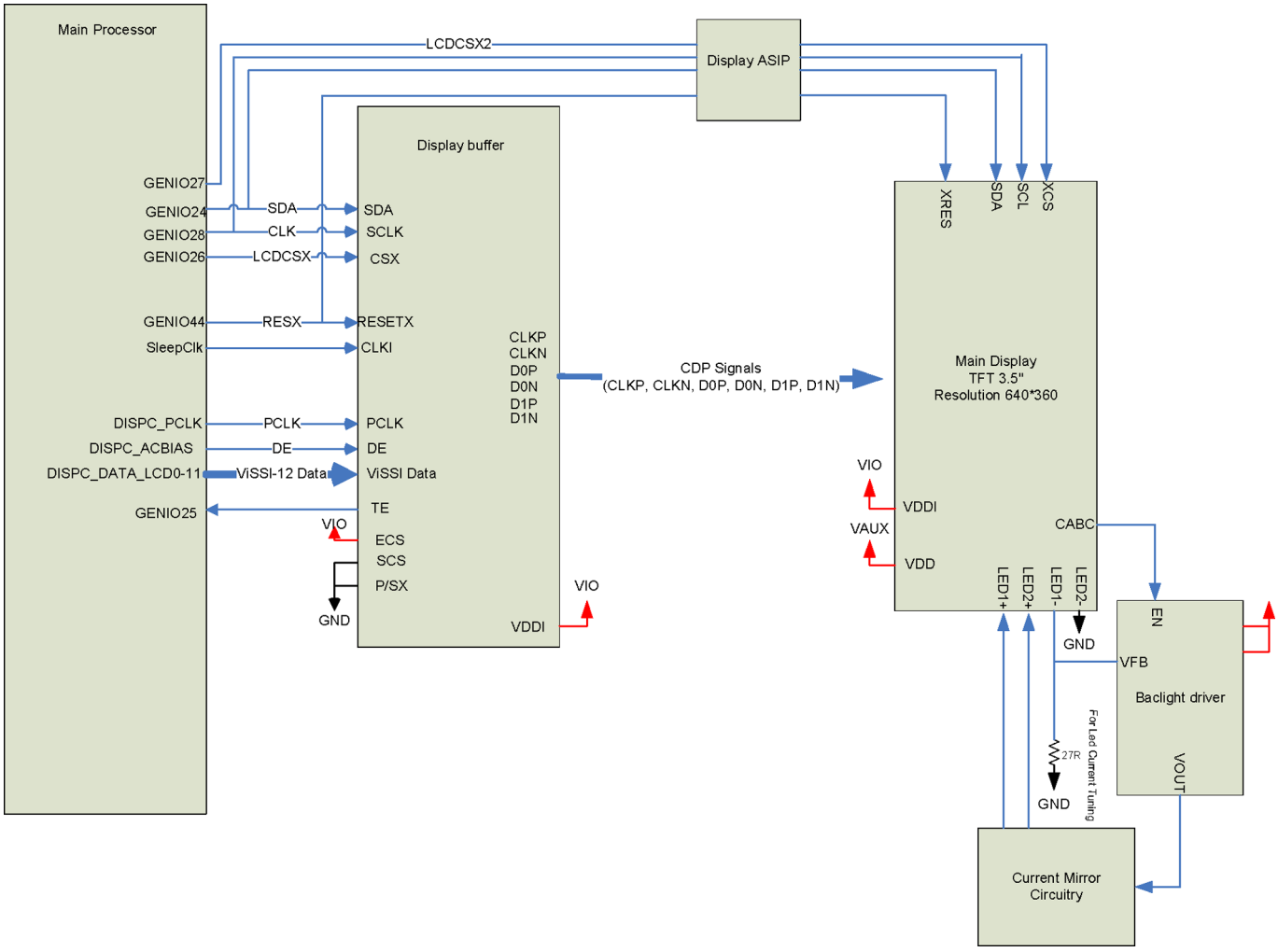

Figure 76 Display block diagram

Backlight and illumination

This device has two backlighting systems; one for the display and one for the HW keys and other illumination zones.

Backlighting for HW keys

The L5521 LED contoller is used for backlightning the HW keys . There is one LP5521 in the reference HW making it possible to have up to three LED zones. It can also drive the RGB LED.

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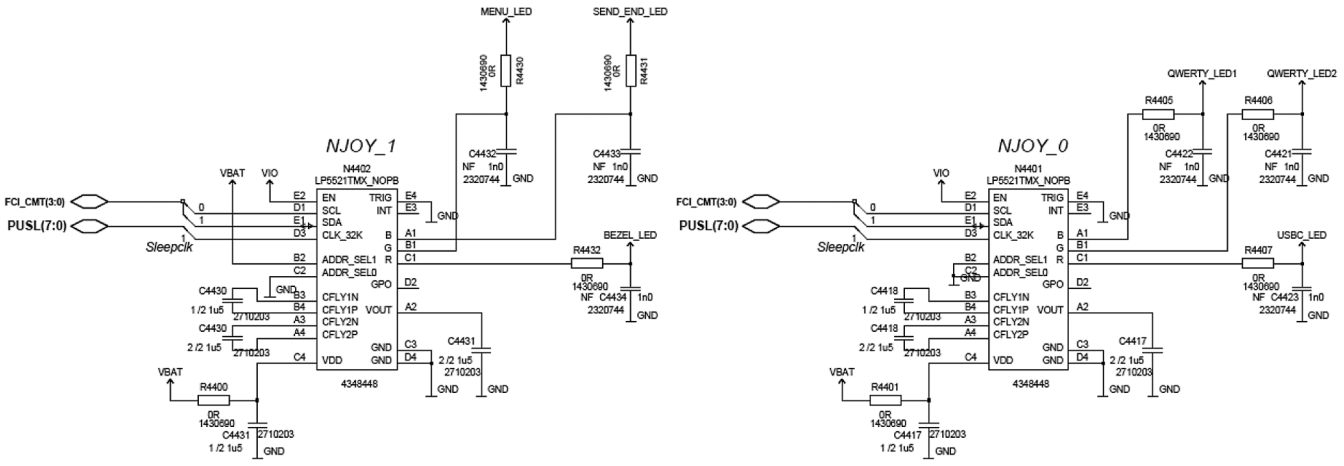

Figure 77 Backlight control for HW keys

Display backlights

Display backlights consist of two LED chains, each containing three LEDs in series powered by TPA61061 switching mode power supply. Display backlight brightness is controlled by the CABC signal, and the equality of the current (and thus the brightness) through the two LED chains is ensured by a current mirror.

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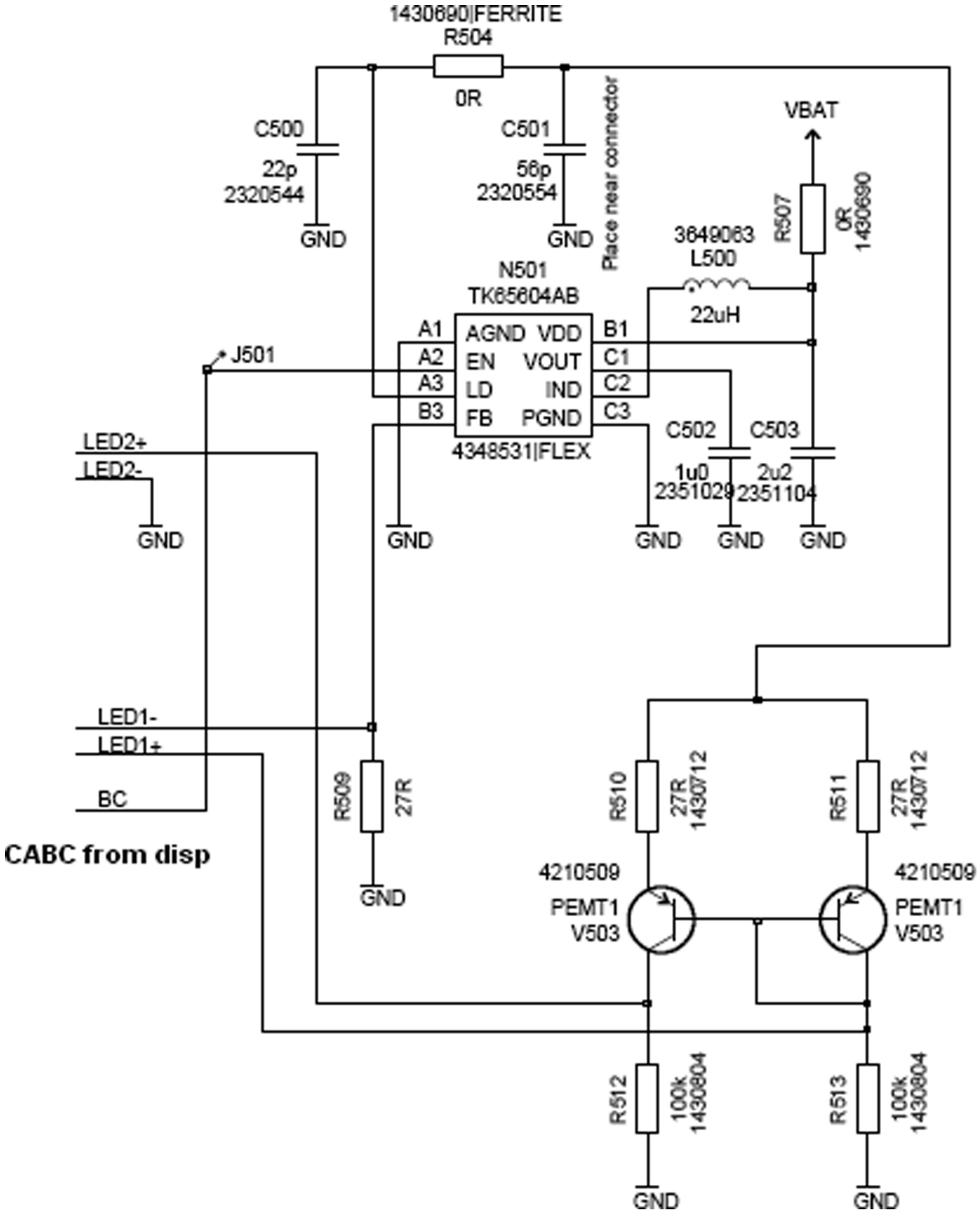

Figure 78 Display backlighting system

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Digital Ambient Light Sensor (ALS)

The Digital Ambient Light Sensor (N503 on Tilt FPC) approximates ambient light. Ambient light level together with CABC and user settings adjust the display and keyboard illumination brightness. The Ambient Light Sensor is located on the upper flex.

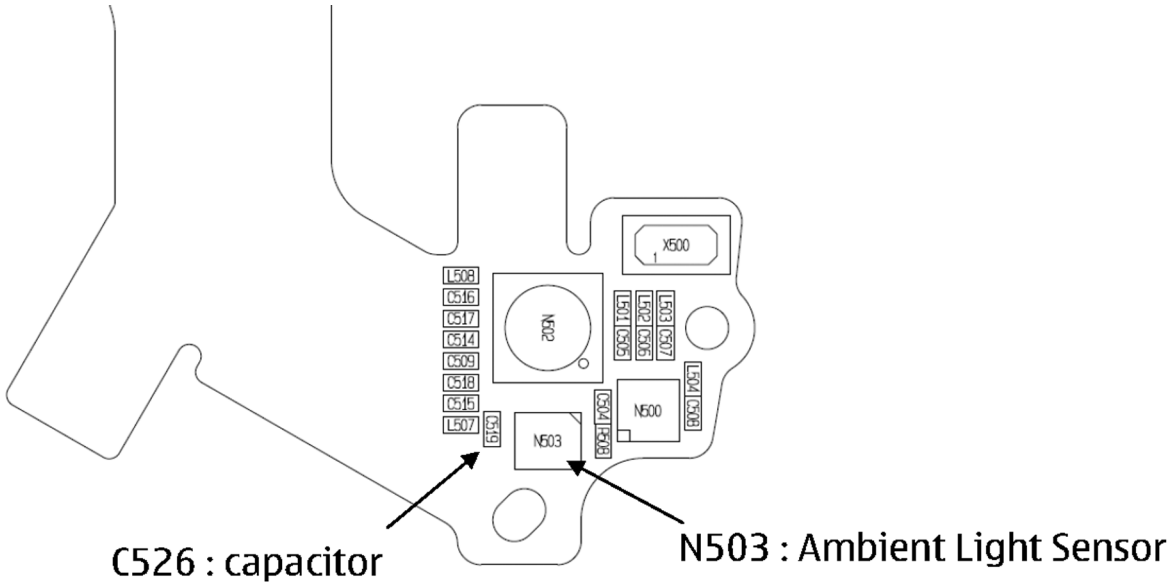

Figure 79 Digital Ambient Light Sensor location

It is connected to the I2C bus, and powered by the VOUT (2.5V) voltage.

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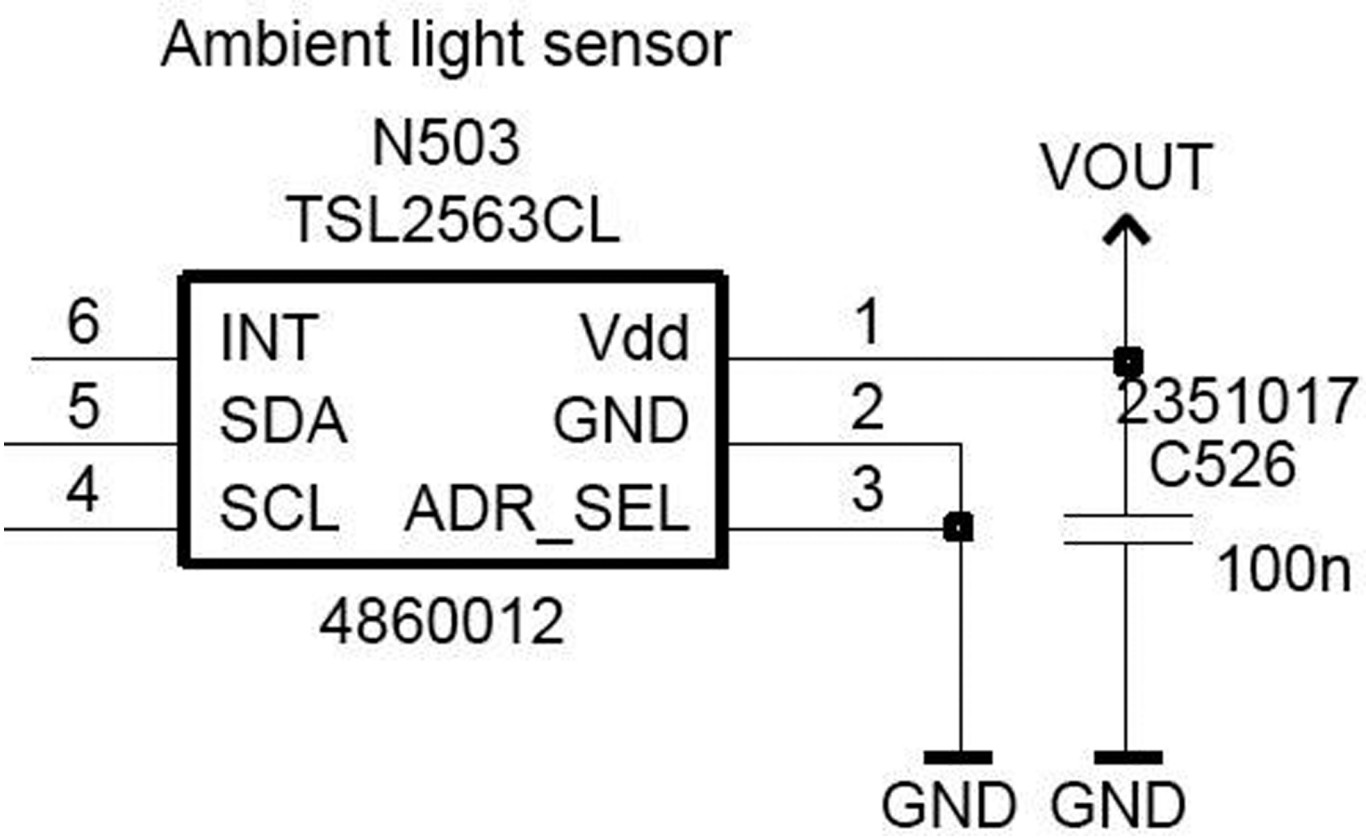

Figure 80 Digital Ambient light sensor schematics

ASICs

RAPIDOYAWE

RAPIDOYAWE ASIC (D2800) is a die-stacked Processor (RAPIDO) with 3G HDSPA logic (YAWE). RAM memory is integrated into RAPIDO.

EM ASIC BETTY N2300

The EM ASIC (N2300) includes the following functional blocks:

- Core supply generation
- Charge control circuitry
- Level shifter and regulator for USB/FBUS
- Current gauge for battery current measuring
- LED control for display backlighting
- Digital interface (CBUS)

EM ASIC VILMA N2200

The EM ASIC (N2200) includes the following functional blocks:

- Start up logic and reset control
- Charger detection
- Battery voltage monitoring
- 32.768kHz clock with external crystal
- Real time clock with external backup battery

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- SIM card interface
- Stereo audio codecs and amplifiers
- A/D converter
- Regulators
- Vibra interface
- Digital interface (CBUS)

EMC ASIP (Appcation Specified Integrated Passive) have been integrated inside the ASIC. It includes biasing passives for microphone , EMC filter for SIM, microphones etc.

Device memories

Combo memory

The memory of the device consists of stacked DDR SDRAM and MuxedMassMemory (M3). Combo memory DDR/ M3 memory has 1Gb DDR + 2Gb M3.

Audio concept

Audio HW architecture

The functional core of the audio hardware is built around three ASICs: RAPIDOYAWE engine ASIC, mixed signal ASIC Avilma and D/A converter DAC33.

DAC33 converts digital audio signal to analog and is routed to the FM Transmitter and amplifier TPA6130 which provides an interface for the transducers and the accessory connector.

AVilma provides analog signal for earpiece and for D-class audio amplifier TPA2012D2, which drives integrated stereo handsfree speakers.

There are four audio transducers:

- 5x10 mm dynamic earpiece
- Two 8x12 mm dynamic speakers
- Digital microphone

Avilma provides an output for the dynamic vibra component. All wired audio accessories are connected to the AV accessory connector. A Bluetooth audio and FM radio module, which is connected to RAPIDOYAWE, supports Bluetooth audio and FM radio functionality.

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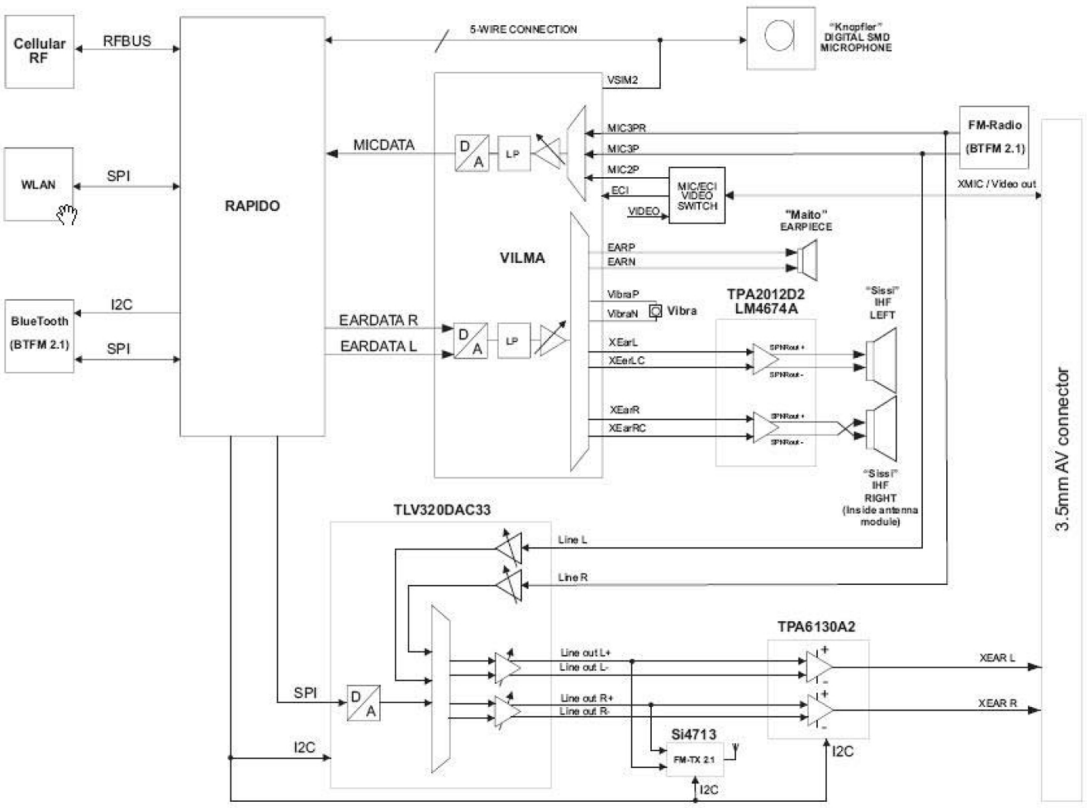

Figure 81 Audio system block

Internal microphone

The internal microphone is used for HandPortable (HP) and Internal HandsFree (IHF) call modes. A digital microphone data and clock line are connected to Rapidoyawe and operating voltage is received from Avilma.

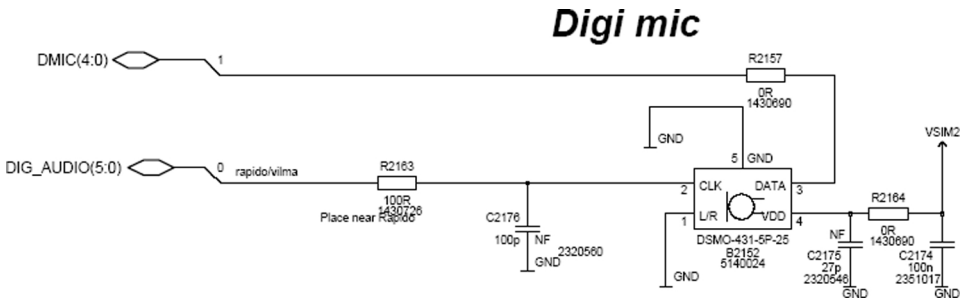

Figure 82 Internal microphone

Internal earpiece

Internal earpiece is used for the HandPortable (HP) call mode. A dynamic 5x10 mm earpiece capsule is Connected to Avilma ASIC's differential output EarP and EarN.

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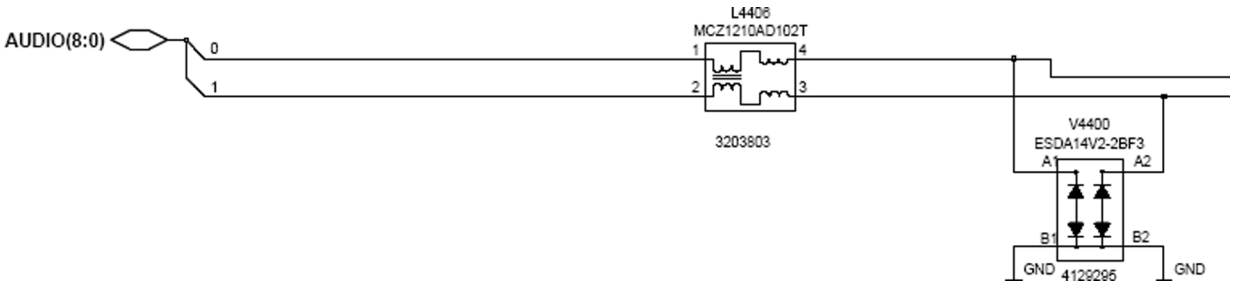

Figure 83 Internal earpiece circuitry

Internal speakers

Internal speakers are used for Internal HandsFree (IHF) call mode, video call, ringing tones, FM radio and music listening.

Two dynamic 8x12mm speakers are connected to Avilma ASIC's outputs XearR/XearL via stereo D-class IHF amplifier TPA2012D2. The amplifier has 12 dB fixed gain and it is put to shutdown mode when not in use.

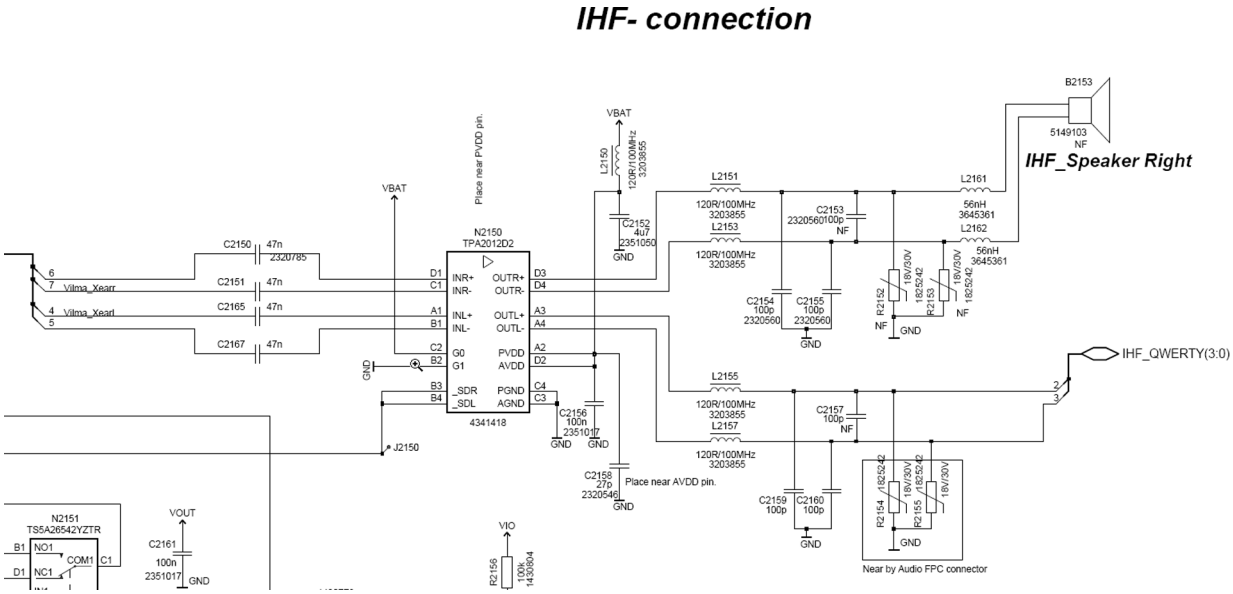

Figure 84 Internal speakers

Vibra circuitry

Vibra is used for the vibra alarm function.

The vibra motor is connected to the Avilma ASIC VibraP and VibraN Pulse Width Modulated (PWM) outputs.

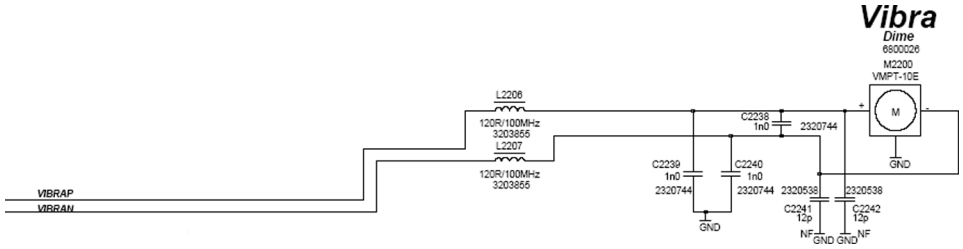

Figure 85 Vibra circuitry

Accessory AV connector

The features that are supported by Ivalo accessory interface are the following:

- Audio output (stereo headset/headphones having the impedance >16ohm)

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- Audio input (mono microphone from headset)
- Control data (ECI)
- TV-out with composite signal to 75ohm coax cable
- Connects FM receiver to headphones, which serves as FM antenna

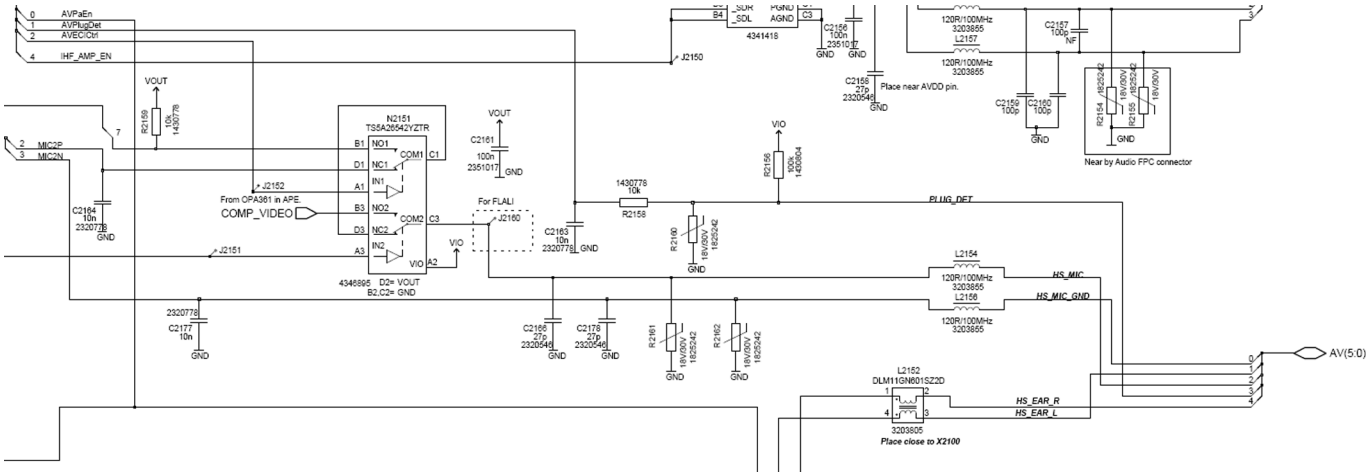

Figure 86 Accessory (AV) connector

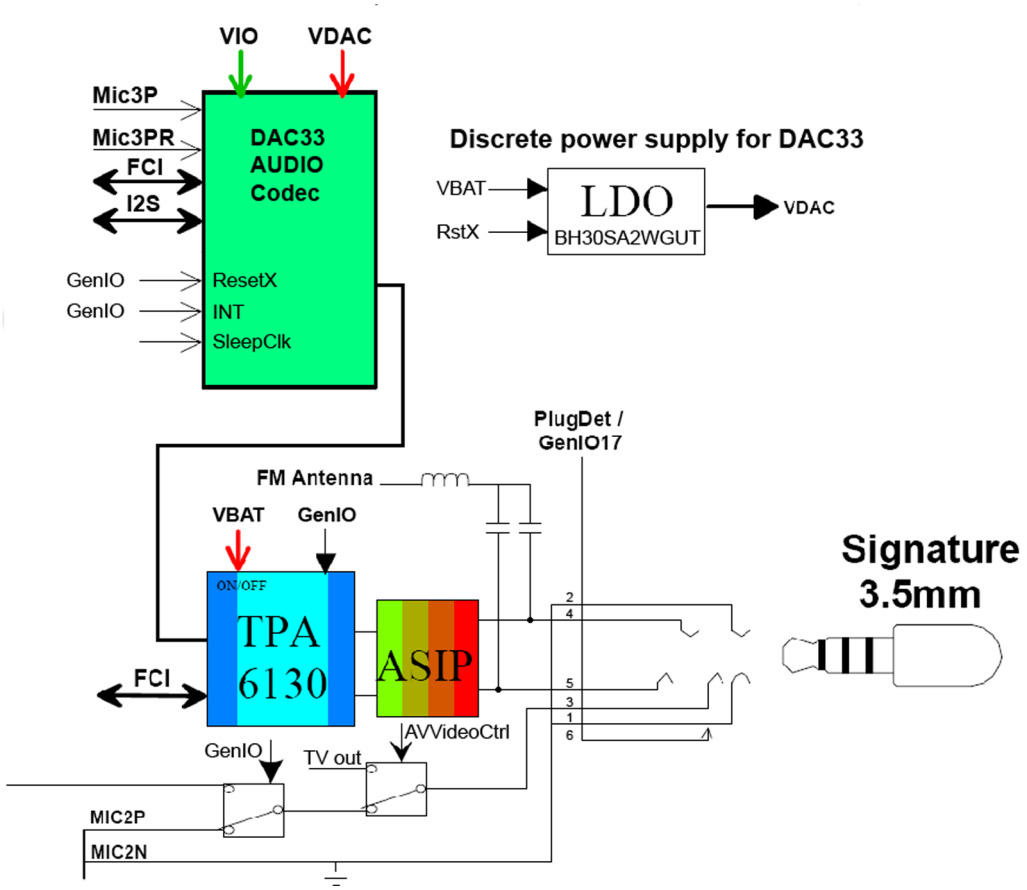

Figure 87 Accessory (AV) connector with DAC33 and TPA6130 audio enhancements

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DA converter, headphone amplifier and FM transmitter

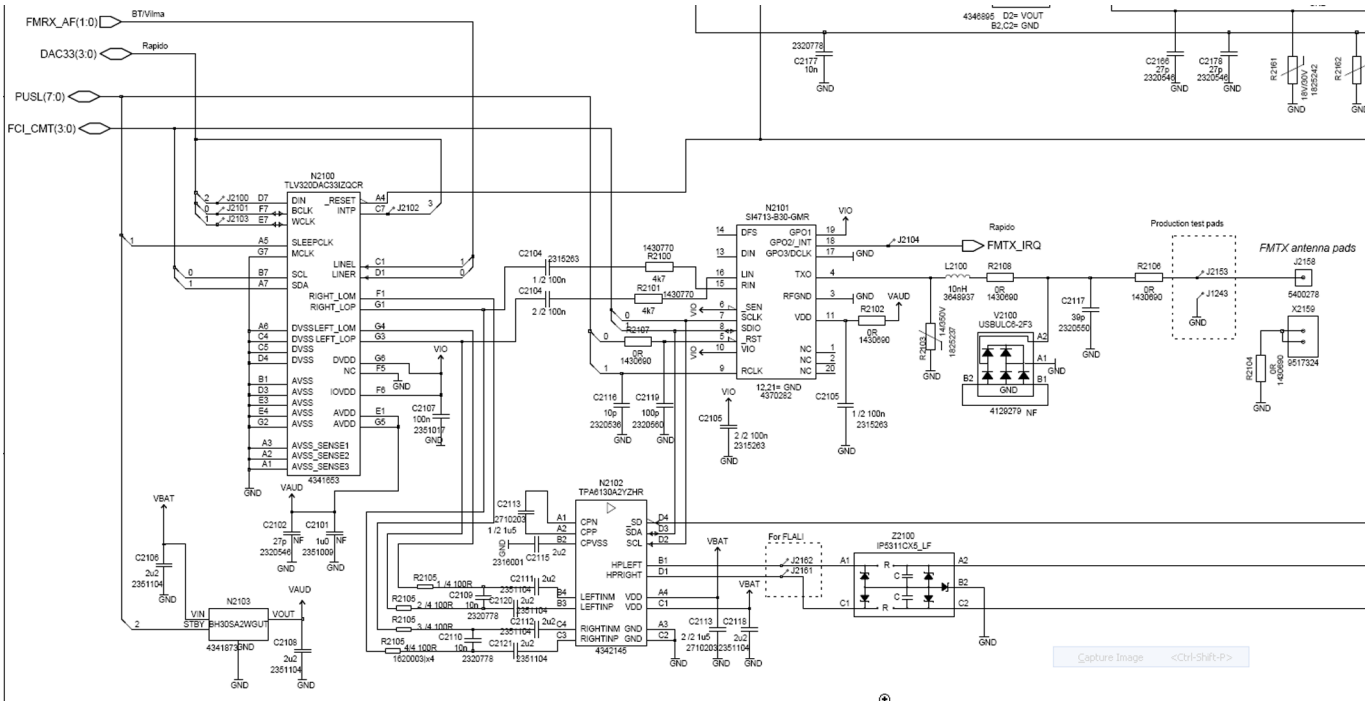

Figure 88 DA converter, headphone amplifier & FM transmitter

Baseband technical specifications

External interfaces

Name of connection	Connector reference
HS USB	X3300
MicroSD card	X300 on Bezel FPC
Battery connector	X2070
SIM card reader	X2700
Accessory (AV) connector	X401 on Audio FPC

SIM IF connections

Pin	Signal	I/O	Engine connection		Notes
1	VSIM1	Out	EM ASIC N2200	VSIM1	Supply voltage to SIM card, 1.8V or 3.0V.
2	SIMRST	Out	EM ASIC N2200	SIM1Rst	Reset signal to SIM card
3	SIMCLK	Out	EM ASIC N2200	SIM1ClkC	Clock signal to SIM card

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Pin	Signal	I/O	Engine connection		Notes
5	GND	-	GND		Ground
7	SIMDATA	In/Out	EM ASIC N2200	SIM1DaC	Data input / output

Charger connector and charging interface connections & electrical characteristics

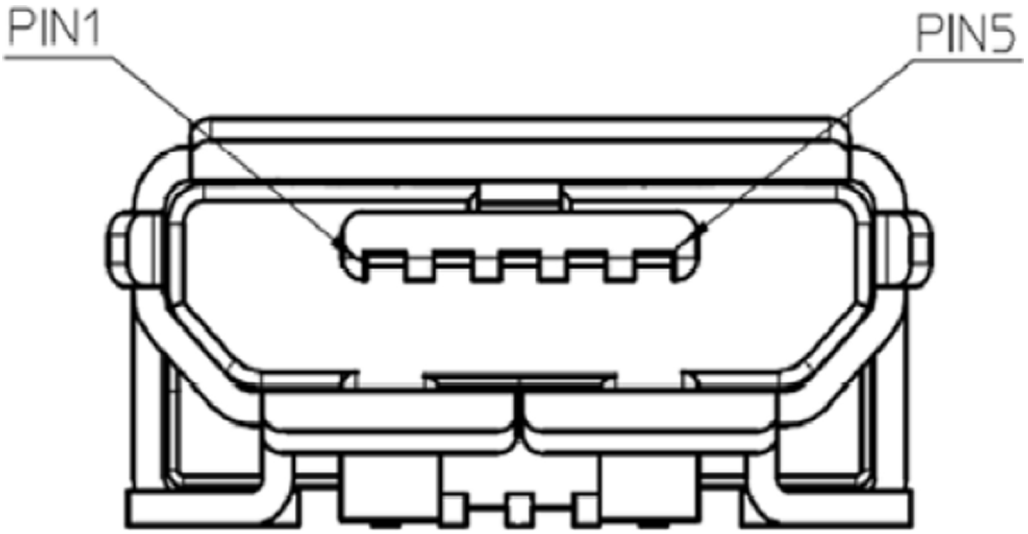

Figure 89 Charger connector

Table 15 Charging interface connections

PIN	Signal	I/O	Engine connection		Description
1	VBUS	IN	D3300/ N3301	VBUS/DCIN	5V
2	D-	IN/OUT	D3300	DM	Data minus
3	D+	IN/OUT	D3300	DN	Data plus
4	ID				Not in use
5	ground		Ground		Signal ground

Table 16 Charging IF electrical characteristics

Description	Parameter	Min	Max	Unit
VBUS	Vcharge	4.75	5.25	V
VBUS	Icharge		1.8	A
D+,D-,Ground			1	A

Internal interfaces

Name of connection	Component reference
Earpiece	B500 on Tilt FPC

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Name of connection	Component reference
Microphone	B2152
IHF speakers	B2153, B400 on Audio FPC
Main camera	X9001
Sub-camera	N502 on Tilt FPC
Main display connector	X501 on Tilt FPC
Vibra	M2200

Back-up battery interface electrical characteristics

Table 17 Back-up battery electrical characteristics

Description	Parameter	Min	Typ	Max	Unit
Back-Up Battery Voltage	Vback	0	2.5	2.7	V

RF technical description

RF block diagram

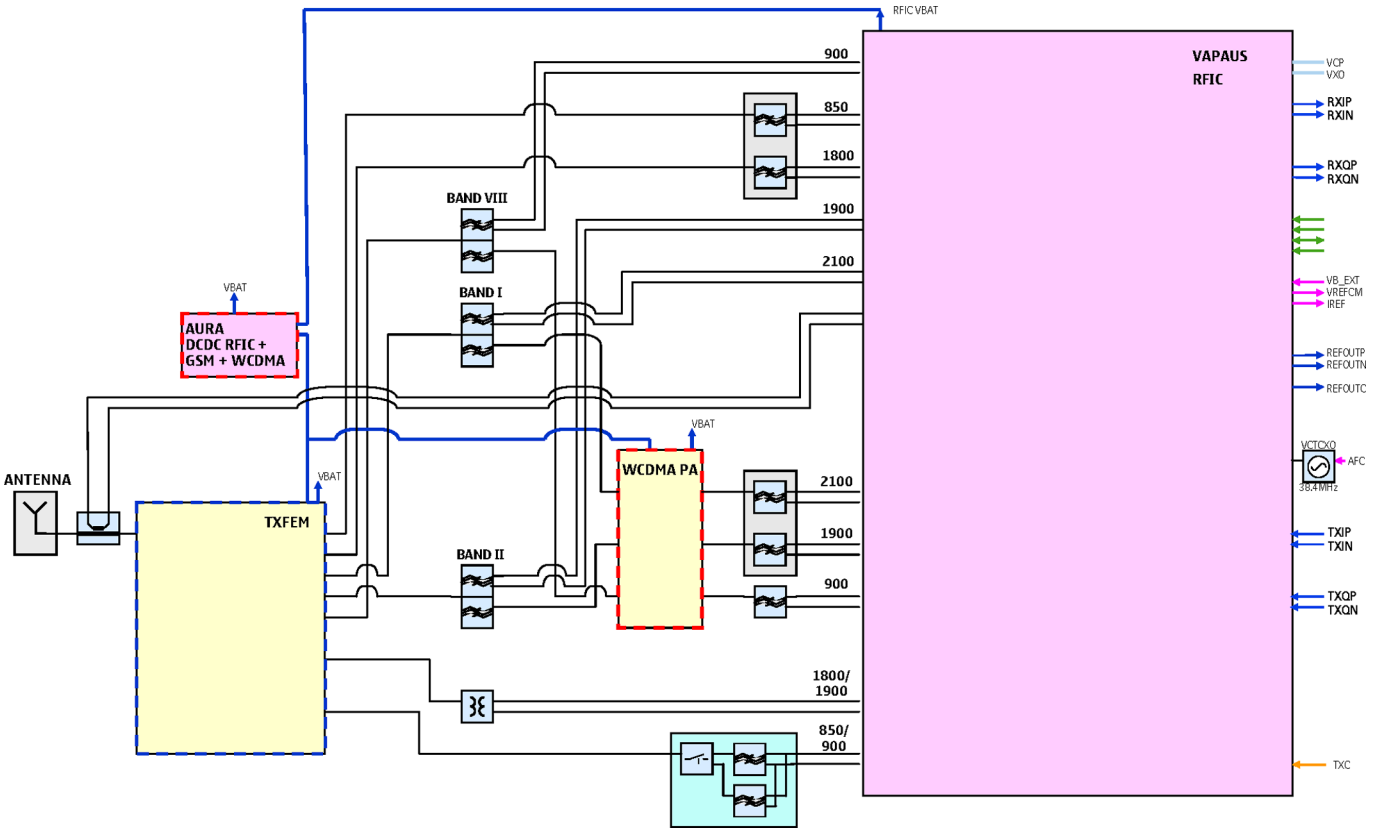

Figure 90 RF block diagram using RF ASIC N7500 (with WCDMA VII/II/I)

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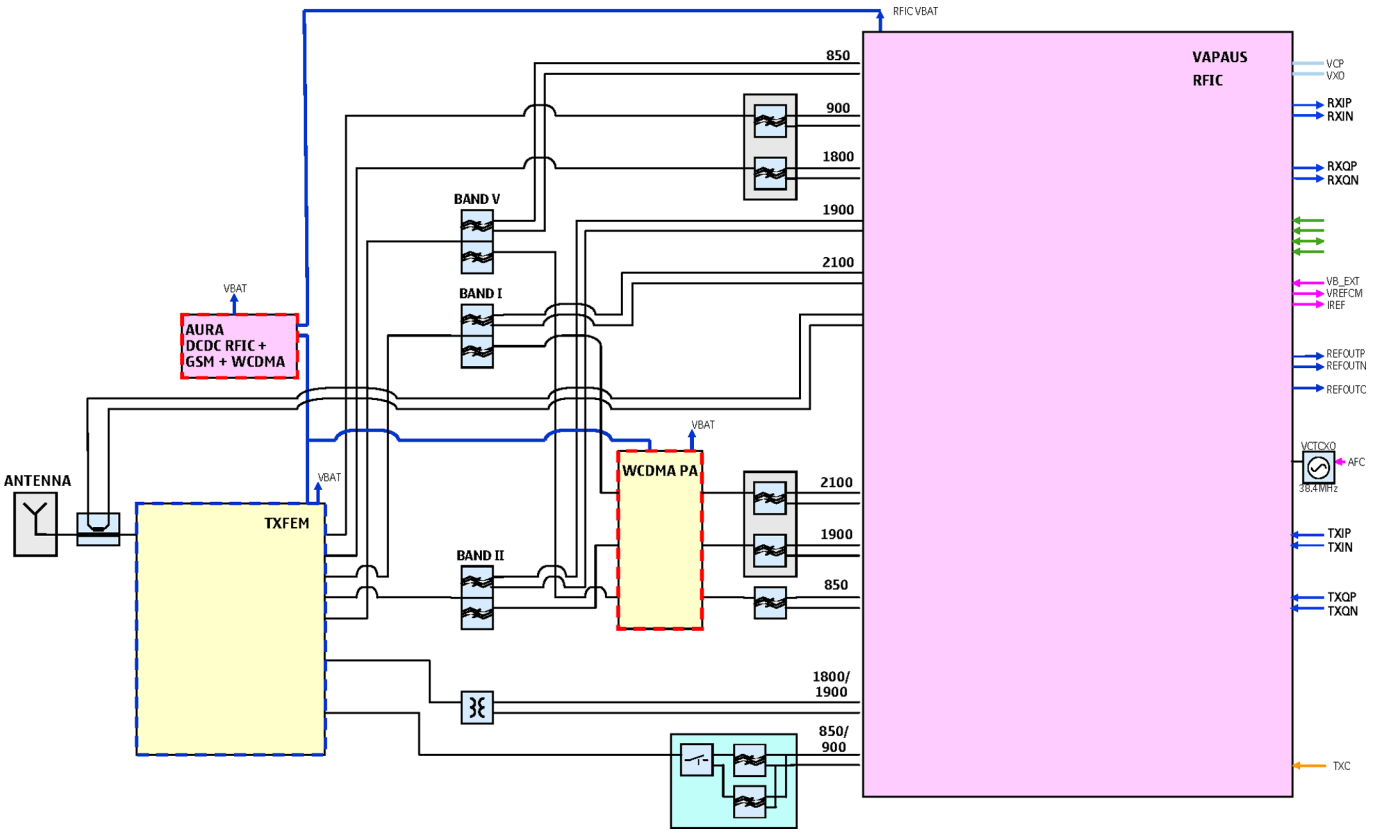

Figure 91 RF block diagram using RF ASIC N7500 (with WCDMA V/II/I)

The RF block diagram uses RF ASIC N7500 that performs the RF back-end functions of receive and transmit function of the cellular transceiver.

Receiver (RX)

An analogue signal is received by the phone's antenna. The signal is converted to a digital signal and is then transferred further to the baseband (eg. to the earpiece).

The receiver functions are implemented in the RF ASIC.

Signals with different frequencies take different paths, therefore being handled by different components. The principle of GSM and WCDMA is the same.

Transmitter (TX)

The digital baseband signal (eg. from the microphone) is converted to an analogue signal, which is then amplified and transmitted from the antenna. The frequency of this signal can be tuned to match the bandwith of the system in use (eg. GSM900).

The transmitter functions are implemented in the RF ASIC.

Even though the GSM and WCDMA signals are sent via different components, the principles of the transmission is the same.

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Frequency mappings

GSM850 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
128	824.2	869.2	3296.8	3476.8	170	832.6	877.6	3330.4	3510.4	212	841.0	886.0	3364.0	3544.0
129	824.4	869.4	3297.6	3477.6	171	832.8	877.8	3331.2	3511.2	213	841.2	886.2	3364.8	3544.8
130	824.6	869.6	3298.4	3478.4	172	833.0	878.0	3332.0	3512.0	214	841.4	886.4	3365.6	3545.6
131	824.8	869.8	3299.2	3479.2	173	833.2	878.2	3332.8	3512.8	215	841.6	886.6	3366.4	3546.4
132	825.0	870.0	3300.0	3480.0	174	833.4	878.4	3333.6	3513.6	216	841.8	886.8	3367.2	3547.2
133	825.2	870.2	3300.8	3480.8	175	833.6	878.6	3334.4	3514.4	217	842.0	887.0	3368.0	3548.0
134	825.4	870.4	3301.6	3481.6	176	833.8	878.8	3335.2	3515.2	218	842.2	887.2	3368.8	3548.8
135	825.6	870.6	3302.4	3482.4	177	834.0	879.0	3336.0	3516.0	219	842.4	887.4	3369.6	3549.6
136	825.8	870.8	3303.2	3483.2	178	834.2	879.2	3336.8	3516.8	220	842.6	887.6	3370.4	3550.4
137	826.0	871.0	3304.0	3484.0	179	834.4	879.4	3337.6	3517.6	221	842.8	887.8	3371.2	3551.2
138	826.2	871.2	3304.8	3484.8	180	834.6	879.6	3338.4	3518.4	222	843.0	888.0	3372.0	3552.0
139	826.4	871.4	3305.6	3485.6	181	834.8	879.8	3339.2	3519.2	223	843.2	888.2	3372.8	3552.8
140	826.6	871.6	3306.4	3486.4	182	835.0	880.0	3340.0	3520.0	224	843.4	888.4	3373.6	3553.6
141	826.8	871.8	3307.2	3487.2	183	835.2	880.2	3340.8	3520.8	225	843.6	888.6	3374.4	3554.4
142	827.0	872.0	3308.0	3488.0	184	835.4	880.4	3341.6	3521.6	226	843.8	888.8	3375.2	3555.2
143	827.2	872.2	3308.8	3488.8	185	835.6	880.6	3342.4	3522.4	227	844.0	889.0	3376.0	3556.0
144	827.4	872.4	3309.6	3489.6	186	835.8	880.8	3343.2	3523.2	228	844.2	889.2	3376.8	3556.8
145	827.6	872.6	3310.4	3490.4	187	836.0	881.0	3344.0	3524.0	229	844.4	889.4	3377.6	3557.6
146	827.8	872.8	3311.2	3491.2	188	836.2	881.2	3344.8	3524.8	230	844.6	889.6	3378.4	3558.4
147	828.0	873.0	3312.0	3492.0	189	836.4	881.4	3345.6	3525.6	231	844.8	889.8	3379.2	3559.2
148	828.2	873.2	3312.8	3492.8	190	836.6	881.6	3346.4	3526.4	232	845.0	890.0	3380.0	3560.0
149	828.4	873.4	3313.6	3493.6	191	836.8	881.8	3347.2	3527.2	233	845.2	890.2	3380.8	3560.8
150	828.6	873.6	3314.4	3494.4	192	837.0	882.0	3348.0	3528.0	234	845.4	890.4	3381.6	3561.6
151	828.8	873.8	3315.2	3495.2	193	837.2	882.2	3348.8	3528.8	235	845.6	890.6	3382.4	3562.4
152	829.0	874.0	3316.0	3496.0	194	837.4	882.4	3349.6	3529.6	236	845.8	890.8	3383.2	3563.2
153	829.2	874.2	3316.8	3496.8	195	837.6	882.6	3350.4	3530.4	237	846.0	891.0	3384.0	3564.0
154	829.4	874.4	3317.6	3497.6	196	837.8	882.8	3351.2	3531.2	238	846.2	891.2	3384.8	3564.8
155	829.6	874.6	3318.4	3498.4	197	838.0	883.0	3352.0	3532.0	239	846.4	891.4	3385.6	3565.6
156	829.8	874.8	3319.2	3499.2	198	838.2	883.2	3352.8	3532.8	240	846.6	891.6	3386.4	3566.4
157	830.0	875.0	3320.0	3500.0	199	838.4	883.4	3353.6	3533.6	241	846.8	891.8	3387.2	3567.2
158	830.2	875.2	3320.8	3500.8	200	838.6	883.6	3354.4	3534.4	242	847.0	892.0	3388.0	3568.0
159	830.4	875.4	3321.6	3501.6	201	838.8	883.8	3355.2	3535.2	243	847.2	892.2	3388.8	3568.8
160	830.6	875.6	3322.4	3502.4	202	839.0	884.0	3356.0	3536.0	244	847.4	892.4	3389.6	3569.6
161	830.8	875.8	3323.2	3503.2	203	839.2	884.2	3356.8	3536.8	245	847.6	892.6	3390.4	3570.4
162	831.0	876.0	3324.0	3504.0	204	839.4	884.4	3357.6	3537.6	246	847.8	892.8	3391.2	3571.2
163	831.2	876.2	3324.8	3504.8	205	839.6	884.6	3358.4	3538.4	247	848.0	893.0	3392.0	3572.0
164	831.4	876.4	3325.6	3505.6	206	839.8	884.8	3359.2	3539.2	248	848.2	893.2	3392.8	3572.8
165	831.6	876.6	3326.4	3506.4	207	840.0	885.0	3360.0	3540.0	249	848.4	893.4	3393.6	3573.6
166	831.8	876.8	3327.2	3507.2	208	840.2	885.2	3360.8	3540.8	250	848.6	893.6	3394.4	3574.4
167	832.0	877.0	3328.0	3508.0	209	840.4	885.4	3361.6	3541.6	251	848.8	893.8	3395.2	3575.2

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EGSM900 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
975	880,2	925,2	3520,8	3700,8	1	890,2	935,2	3560,8	3740,8	63	902,6	947,6	3610,4	3790,4
976	880,4	925,4	3521,6	3701,6	2	890,4	935,4	3561,6	3741,6	64	902,8	947,8	3611,2	3791,2
977	880,6	925,6	3522,4	3702,4	3	890,6	935,6	3562,4	3742,4	65	903,0	948,0	3612,0	3792,0
978	880,8	925,8	3523,2	3703,2	4	890,8	935,8	3563,2	3743,2	66	903,2	948,2	3612,8	3792,8
979	881,0	926,0	3524,0	3704,0	5	891,0	936,0	3564,0	3744,0	67	903,4	948,4	3613,6	3793,6
980	881,2	926,2	3524,8	3704,8	6	891,2	936,2	3564,8	3744,8	68	903,6	948,6	3614,4	3794,4
981	881,4	926,4	3525,6	3705,6	7	891,4	936,4	3565,6	3745,6	69	903,8	948,8	3615,2	3795,2
982	881,6	926,6	3526,4	3706,4	8	891,6	936,6	3566,4	3746,4	70	904,0	949,0	3616,0	3796,0
983	881,8	926,8	3527,2	3707,2	9	891,8	936,8	3567,2	3747,2	71	904,2	949,2	3616,8	3796,8
984	882,0	927,0	3528,0	3708,0	10	892,0	937,0	3568,0	3748,0	72	904,4	949,4	3617,6	3797,6
985	882,2	927,2	3528,8	3708,8	11	892,2	937,2	3568,8	3748,8	73	904,6	949,6	3618,4	3798,4
986	882,4	927,4	3529,6	3709,6	12	892,4	937,4	3569,6	3749,6	74	904,8	949,8	3619,2	3799,2
987	882,6	927,6	3530,4	3710,4	13	892,6	937,6	3570,4	3750,4	75	905,0	950,0	3620,0	3800,0
988	882,8	927,8	3531,2	3711,2	14	892,8	937,8	3571,2	3751,2	76	905,2	950,2	3620,8	3800,8
989	883,0	928,0	3532,0	3712,0	15	893,0	938,0	3572,0	3752,0	77	905,4	950,4	3621,6	3801,6
990	883,2	928,2	3532,8	3712,8	16	893,2	938,2	3572,8	3752,8	78	905,6	950,6	3622,4	3802,4
991	883,4	928,4	3533,6	3713,6	17	893,4	938,4	3573,6	3753,6	79	905,8	950,8	3623,2	3803,2
992	883,6	928,6	3534,4	3714,4	18	893,6	938,6	3574,4	3754,4	80	906,0	951,0	3624,0	3804,0
993	883,8	928,8	3535,2	3715,2	19	893,8	938,8	3575,2	3755,2	81	906,2	951,2	3624,8	3804,8
994	884,0	929,0	3536,0	3716,0	20	894,0	939,0	3576,0	3756,0	82	906,4	951,4	3625,6	3805,6
995	884,2	929,2	3536,8	3716,8	21	894,2	939,2	3576,8	3756,8	83	906,6	951,6	3626,4	3806,4
996	884,4	929,4	3537,6	3717,6	22	894,4	939,4	3577,6	3757,6	84	906,8	951,8	3627,2	3807,2
997	884,6	929,6	3538,4	3718,4	23	894,6	939,6	3578,4	3758,4	85	907,0	952,0	3628,0	3808,0
998	884,8	929,8	3539,2	3719,2	24	894,8	939,8	3579,2	3759,2	86	907,2	952,2	3628,8	3808,8
999	885,0	930,0	3540,0	3720,0	25	895,0	940,0	3580,0	3760,0	87	907,4	952,4	3629,6	3809,6
1000	885,2	930,2	3540,8	3720,8	26	895,2	940,2	3580,8	3760,8	88	907,6	952,6	3630,4	3810,4
1001	885,4	930,4	3541,6	3721,6	27	895,4	940,4	3581,6	3761,6	89	907,8	952,8	3631,2	3811,2
1002	885,6	930,6	3542,4	3722,4	28	895,6	940,6	3582,4	3762,4	90	908,0	953,0	3632,0	3812,0
1003	885,8	930,8	3543,2	3723,2	29	895,8	940,8	3583,2	3763,2	91	908,2	953,2	3632,8	3812,8
1004	886,0	931,0	3544,0	3724,0	30	896,0	941,0	3584,0	3764,0	92	908,4	953,4	3633,6	3813,6
1005	886,2	931,2	3544,8	3724,8	31	896,2	941,2	3584,8	3764,8	93	908,6	953,6	3634,4	3814,4
1006	886,4	931,4	3545,6	3725,6	32	896,4	941,4	3585,6	3765,6	94	908,8	953,8	3635,2	3815,2
1007	886,6	931,6	3546,4	3726,4	33	896,6	941,6	3586,4	3766,4	95	909,0	954,0	3636,0	3816,0
1008	886,8	931,8	3547,2	3727,2	34	896,8	941,8	3587,2	3767,2	96	909,2	954,2	3636,8	3816,8
1009	887,0	932,0	3548,0	3728,0	35	897,0	942,0	3588,0	3768,0	97	909,4	954,4	3637,6	3817,6
1010	887,2	932,2	3548,8	3728,8	36	897,2	942,2	3588,8	3768,8	98	909,6	954,6	3638,4	3818,4
1011	887,4	932,4	3549,6	3729,6	37	897,4	942,4	3589,6	3769,6	99	909,8	954,8	3639,2	3819,2
1012	887,6	932,6	3550,4	3730,4	38	897,6	942,6	3590,4	3770,4	100	910,0	955,0	3640,0	3820,0
1013	887,8	932,8	3551,2	3731,2	39	897,8	942,8	3591,2	3771,2	101	910,2	955,2	3640,8	3820,8
1014	888,0	933,0	3552,0	3732,0	40	898,0	943,0	3592,0	3772,0	102	910,4	955,4	3641,6	3821,6
1015	888,2	933,2	3552,8	3732,8	41	898,2	943,2	3592,8	3772,8	103	910,6	955,6	3642,4	3822,4
1016	888,4	933,4	3553,6	3733,6	42	898,4	943,4	3593,6	3773,6	104	910,8	955,8	3643,2	3823,2
1017	888,6	933,6	3554,4	3734,4	43	898,6	943,6	3594,4	3774,4	105	911,0	956,0	3644,0	3824,0
1018	888,8	933,8	3555,2	3735,2	44	898,8	943,8	3595,2	3775,2	106	911,2	956,2	3644,8	3824,8
1019	889,0	934,0	3556,0	3736,0	45	899,0	944,0	3596,0	3776,0	107	911,4	956,4	3645,6	3825,6
1020	889,2	934,2	3556,8	3736,8	46	899,2	944,2	3596,8	3776,8	108	911,6	956,6	3646,4	3826,4
1021	889,4	934,4	3557,6	3737,6	47	899,4	944,4	3597,6	3777,6	109	911,8	956,8	3647,2	3827,2
1022	889,6	934,6	3558,4	3738,4	48	899,6	944,6	3598,4	3778,4	110	912,0	957,0	3648,0	3828,0
1023	889,8	934,8	3559,2	3739,2	49	899,8	944,8	3599,2	3779,2	111	912,2	957,2	3648,8	3828,8
0	890,0	935,0	3560,0	3740,0	50	900,0	945,0	3600,0	3780,0	112	912,4	957,4	3649,6	3829,6
					51	900,2	945,2	3600,8	3780,8	113	912,6	957,6	3650,4	3830,4
					52	900,4	945,4	3601,6	3781,6	114	912,8	957,8	3651,2	3831,2
					53	900,6	945,6	3602,4	3782,4	115	913,0	958,0	3652,0	3832,0
					54	900,8	945,8	3603,2	3783,2	116	913,2	958,2	3652,8	3832,8
					55	901,0	946,0	3604,0	3784,0	117	913,4	958,4	3653,6	3833,6
					56	901,2	946,2	3604,8	3784,8	118	913,6	958,6	3654,4	3834,4
					57	901,4	946,4	3605,6	3785,6	119	913,8	958,8	3655,2	3835,2
					58	901,6	946,6	3606,4	3786,4	120	914,0	959,0	3656,0	3836,0
					59	901,8	946,8	3607,2	3787,2	121	914,2	959,2	3656,8	3836,8
					60	902,0	947,0	3608,0	3788,0	122	914,4	959,4	3657,6	3837,6
					61	902,2	947,2	3608,8	3788,8	123	914,6	959,6	3658,4	3838,4
					62	902,4	947,4	3609,6	3789,6	124	914,8	959,8	3659,2	3839,2

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GSM1800 frequencies

Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx
512	1710.2	1805.2	3420.4	3610.4	606	1729.0	1824.0	3458.0	3648.0	700	1747.8	1842.8	3495.6	3685.6	793	1766.4	1861.4	3532.8	3722.8
513	1710.4	1805.4	3420.8	3610.8	607	1729.2	1824.2	3458.4	3648.4	701	1748.0	1843.0	3496.0	3686.0	794	1766.6	1861.6	3533.2	3723.2
514	1710.6	1805.6	3421.2	3611.2	608	1729.4	1824.4	3458.8	3648.8	702	1748.2	1843.2	3496.4	3686.4	795	1766.8	1861.8	3533.6	3723.6
515	1710.8	1805.8	3421.6	3611.6	609	1729.6	1824.6	3459.2	3649.2	703	1748.4	1843.4	3496.8	3686.8	796	1767.0	1862.0	3534.0	3724.0
516	1711.0	1806.0	3422.0	3612.0	610	1729.8	1824.8	3459.6	3649.6	704	1748.6	1843.6	3497.2	3687.2	797	1767.2	1862.2	3534.4	3724.4
517	1711.2	1806.2	3422.4	3612.4	611	1730.0	1825.0	3460.0	3650.0	705	1748.8	1843.8	3497.6	3687.6	798	1767.4	1862.4	3534.8	3724.8
518	1711.4	1806.4	3422.8	3612.8	612	1730.2	1825.2	3460.4	3650.4	706	1749.0	1844.0	3498.0	3688.0	799	1767.6	1862.6	3535.2	3725.2
519	1711.6	1806.6	3423.2	3613.2	613	1730.4	1825.4	3460.8	3650.8	707	1749.2	1844.2	3498.4	3688.4	800	1767.8	1862.8	3535.6	3725.6
520	1711.8	1806.8	3423.6	3613.6	614	1730.6	1825.6	3461.2	3651.2	708	1749.4	1844.4	3498.8	3688.8	801	1768.0	1863.0	3536.0	3726.0
521	1712.0	1807.0	3424.0	3614.0	615	1730.8	1825.8	3461.6	3651.6	709	1749.6	1844.6	3499.2	3689.2	802	1768.2	1863.2	3536.4	3726.4
522	1712.2	1807.2	3424.4	3614.4	616	1731.0	1826.0	3462.0	3652.0	710	1749.8	1844.8	3499.6	3689.6	803	1768.4	1863.4	3536.8	3726.8
523	1712.4	1807.4	3424.8	3614.8	617	1731.2	1826.2	3462.4	3652.4	711	1750.0	1845.0	3500.0	3690.0	804	1768.6	1863.6	3537.2	3727.2
524	1712.6	1807.6	3425.2	3615.2	618	1731.4	1826.4	3462.8	3652.8	712	1750.2	1845.2	3500.4	3690.4	805	1768.8	1863.8	3537.6	3727.6
525	1712.8	1807.8	3425.6	3615.6	619	1731.6	1826.6	3463.2	3653.2	713	1750.4	1845.4	3500.8	3690.8	806	1769.0	1864.0	3538.0	3728.0
526	1713.0	1808.0	3426.0	3616.0	620	1731.8	1826.8	3463.6	3653.6	714	1750.6	1845.6	3501.2	3691.2	807	1769.2	1864.2	3538.4	3728.4
527	1713.2	1808.2	3426.4	3616.4	621	1732.0	1827.0	3464.0	3654.0	715	1750.8	1845.8	3501.6	3691.6	808	1769.4	1864.4	3538.8	3728.8
528	1713.4	1808.4	3426.8	3616.8	622	1732.2	1827.2	3464.4	3654.4	716	1751.0	1846.0	3502.0	3692.0	809	1769.6	1864.6	3539.2	3729.2
529	1713.6	1808.6	3427.2	3617.2	623	1732.4	1827.4	3464.8	3654.8	717	1751.2	1846.2	3502.4	3692.4	810	1769.8	1864.8	3539.6	3729.6
530	1713.8	1808.8	3427.6	3617.6	624	1732.6	1827.6	3465.2	3655.2	718	1751.4	1846.4	3502.8	3692.8	811	1770.0	1865.0	3540.0	3730.0
531	1714.0	1809.0	3428.0	3618.0	625	1732.8	1827.8	3465.6	3655.6	719	1751.6	1846.6	3503.2	3693.2	812	1770.2	1865.2	3540.4	3730.4
532	1714.2	1809.2	3428.4	3618.4	626	1733.0	1828.0	3466.0	3656.0	720	1751.8	1846.8	3503.6	3693.6	813	1770.4	1865.4	3540.8	3730.8
533	1714.4	1809.4	3428.8	3618.8	627	1733.2	1828.2	3466.4	3656.4	721	1752.0	1847.0	3504.0	3694.0	814	1770.6	1865.6	3541.2	3731.2
534	1714.6	1809.6	3429.2	3619.2	628	1733.4	1828.4	3466.8	3656.8	722	1752.2	1847.2	3504.4	3694.4	815	1770.8	1865.8	3541.6	3731.6
535	1714.8	1809.8	3429.6	3619.6	629	1733.6	1828.6	3467.2	3657.2	723	1752.4	1847.4	3504.8	3694.8	816	1771.0	1866.0	3542.0	3732.0
536	1715.0	1810.0	3430.0	3620.0	630	1733.8	1828.8	3467.6	3657.6	724	1752.6	1847.6	3505.2	3695.2	817	1771.2	1866.2	3542.4	3732.4
537	1715.2	1810.2	3430.4	3620.4	631	1734.0	1829.0	3468.0	3658.0	725	1752.8	1847.8	3505.6	3695.6	818	1771.4	1866.4	3542.8	3732.8
538	1715.4	1810.4	3430.8	3620.8	632	1734.2	1829.2	3468.4	3658.4	726	1753.0	1848.0	3506.0	3696.0	819	1771.6	1866.6	3543.2	3733.2
539	1715.6	1810.6	3431.2	3621.2	633	1734.4	1829.4	3468.8	3658.8	727	1753.2	1848.2	3506.4	3696.4	820	1771.8	1866.8	3543.6	3733.6
540	1715.8	1810.8	3431.6	3621.6	634	1734.6	1829.6	3469.2	3659.2	728	1753.4	1848.4	3506.8	3696.8	821	1772.0	1867.0	3544.0	3734.0
541	1716.0	1811.0	3432.0	3622.0	635	1734.8	1829.8	3469.6	3659.6	729	1753.6	1848.6	3507.2	3697.2	822	1772.2	1867.2	3544.4	3734.4
542	1716.2	1811.2	3432.4	3622.4	636	1735.0	1830.0	3470.0	3660.0	730	1753.8	1848.8	3507.6	3697.6	823	1772.4	1867.4	3544.8	3734.8
543	1716.4	1811.4	3432.8	3622.8	637	1735.2	1830.2	3470.4	3660.4	731	1754.0	1849.0	3508.0	3698.0	824	1772.6	1867.6	3545.2	3735.2
544	1716.6	1811.6	3433.2	3623.2	638	1735.4	1830.4	3470.8	3660.8	732	1754.2	1849.2	3508.4	3698.4	825	1772.8	1867.8	3545.6	3735.6
545	1716.8	1811.8	3433.6	3623.6	639	1735.6	1830.6	3471.2	3661.2	733	1754.4	1849.4	3508.8	3698.8	826	1773.0	1868.0	3546.0	3736.0
546	1717.0	1812.0	3434.0	3624.0	640	1735.8	1830.8	3471.6	3661.6	734	1754.6	1849.6	3509.2	3699.2	827	1773.2	1868.2	3546.4	3736.4
547	1717.2	1812.2	3434.4	3624.4	641	1736.0	1831.0	3472.0	3662.0	735	1754.8	1849.8	3509.6	3699.6	828	1773.4	1868.4	3546.8	3736.8
548	1717.4	1812.4	3434.8	3624.8	642	1736.2	1831.2	3472.4	3662.4	736	1755.0	1850.0	3510.0	3700.0	829	1773.6	1868.6	3547.2	3737.2
549	1717.6	1812.6	3435.2	3625.2	643	1736.4	1831.4	3472.8	3662.8	737	1755.2	1850.2	3510.4	3700.4	830	1773.8	1868.8	3547.6	3737.6
550	1717.8	1812.8	3435.6	3625.6	644	1736.6	1831.6	3473.2	3663.2	738	1755.4	1850.4	3510.8	3700.8	831	1774.0	1869.0	3548.0	3738.0
551	1718.0	1813.0	3436.0	3626.0	645	1736.8	1831.8	3473.6	3663.6	739	1755.6	1850.6	3511.2	3701.2	832	1774.2	1869.2	3548.4	3738.4
552	1718.2	1813.2	3436.4	3626.4	646	1737.0	1832.0	3474.0	3664.0	740	1755.8	1850.8	3511.6	3701.6	833	1774.4	1869.4	3548.8	3738.8
553	1718.4	1813.4	3436.8	3626.8	647	1737.2	1832.2	3474.4	3664.4	741	1756.0	1851.0	3512.0	3702.0	834	1774.6	1869.6	3549.2	3739.2
554	1718.6	1813.6	3437.2	3627.2	648	1737.4	1832.4	3474.8	3664.8	742	1756.2	1851.2	3512.4	3702.4	835	1774.8	1869.8	3549.6	3739.6
555	1718.8	1813.8	3437.6	3627.6	649	1737.6	1832.6	3475.2	3665.2	743	1756.4	1851.4	3512.8	3702.8	836	1775.0	1870.0	3550.0	3740.0
556	1719.0	1814.0	3438.0	3628.0	650	1737.8	1832.8	3475.6	3665.6	744	1756.6	1851.6	3513.2	3703.2	837	1775.2	1870.2	3550.4	3740.4
557	1719.2	1814.2	3438.4	3628.4	651	1738.0	1833.0	3476.0	3666.0	745	1756.8	1851.8	3513.6	3703.6	838	1775.4	1870.4	3550.8	3740.8
558	1719.4	1814.4	3438.8	3628.8	652	1738.2	1833.2	3476.4	3666.4	746	1757.0	1852.0	3514.0	3704.0	839	1775.6	1870.6	3551.2	3741.2
559	1719.6	1814.6	3439.2	3629.2	653	1738.4	1833.4	3476.8	3666.8	747	1757.2	1852.2	3514.4	3704.4	840	1775.8	1870.8	3551.6	3741.6
560	1719.8	1814.8	3439.6	3629.6	654	1738.6	1833.6	3477.2	3667.2	748	1757.4	1852.4	3514.8	3704.8	841	1776.0	1871.0	3552.0	3742.0
561	1720.0	1815.0	3440.0	3630.0	655	1738.8	1833.8	3477.6	3667.6	749	1757.6	1852.6	3515.2	3705.2	842	1776.2	1871.2	3552.4	3742.4
562	1720.2	1815.2	3440.4	3630.4	656	1739.0	1834.0	3478.0	3668.0	750	1757.8	1852.8	3515.6	3705.6	843	1776.4	1871.4	3552.8	3742.8
563	1720.4	1815.4	3440.8	3630.8	657	1739.2	1834.2	3478.4	3668.4	751	1758.0	1853.0	3516.0	3706.0	844	1776.6	1871.6	3553.2	3743.2
564	1720.6	1815.6	3441.2	3631.2	658	1739.4	1834.4	3478.8	3668.8	752	1758.2	1853.2	3516.4	3706.4	845	1776.8	1871.8	3553.6	3743.6
565	1720.8	1815.8	3441.6	3631.6	659	1739.6	1834.6	3479.2	3669.2	753	1758.4	1853.4	3516.8	3706.8	846	1777.0	1872.0	3554.0	3744.0
566	1721.0	1816.0	3442.0	3632.0	660	1739.8	1834.8	3479.6	3669.6	754	1758.6	1853.6	3517.2	3707.2	847	1777.2	1872.2	3554.4	3744.4
567	1721.2	1816.2	3442.4	3632.4	661	1740.0	1835.0	3480.0	3670.0	755	1758.8	1853.8	3517.6	3707.6	848	1777.4	1872.4	3554.8	3744.8
568	1721.4	1816.4	3442.8	3632.8	662	1740.2	1835.2	3480.4	3670.4	756	1759.0	1854.0	3518.0	3708.0	849	1777.6	1872.6	3555.2	3745.2
569	1721.6	1816.6	3443.2	3633.2	663	1740.4	1835.4	3480.8	3670.8	757	1759.2	1854.2	3518.4	3708.4	850	1777.8	1872.8	3555.6	3745.6
570	1721.8	1816.8	3443.6	3633.6	664	1740.6	1835.6	3481.2	3671.2	758	1759.4	1854.4	3518.8	3708.8	851	1778.0	1873.0	3556.0	3746.0
571	1722.0	1817.0	3444.0	3634.0	665	1740.8	1835.8	3481.6	3671.6	759	1759.6	1854.6	3519.2	3709.2	852	1778.2	1873.2	3556.4	3746.4
572	1722.2	1817.2	3444.4	3634.4	666	1741.0	1836.0	3482.0	3672.0	760	1759.8	1854.8	3519.6	3709.6	853	1778.4	1873.4	3556.8	3746.8
573	1722.4	1817.4	3444.8	3634.8	667	1741.2	1836.2	3482.4	3672.4	761	1760.0	1855.0	3520.0	3710.0	854	1778.6	1873.6	3557.2	3747.2
574	1722.6	1817.6	3445.2	3635.2	668	1741.4	1836.4	3482.8	3672.8	762	1760.2	1855.2	3520.4	3710.4	855	1778.8	1873.8	3557.6	3747.6
575	1722.8	1817.8	3445.6	3635.6	669	1741.6	1836.6	3483.2	3673.2	763	1760.4	1855.4	3520.8	3710.8	856	1779.0	1874.0	3558.0	3748.0
576	1723.0	1818.0	3446.0	3636.0	670	1741.8	1836.8	3483.6	3673.6	764	1760.6	1855.6	3521.2	3711.2	857	1779.2	1874.2	3558.4	3748.4
577	1723.2	1818.2	3446.4	3636.4	671	1742.0	1837.0	3484.0	3674.0	765	1760.8	1855.8	3521.6	3711.6	858	1779.4	1874.4	3558.8	3748.8
578	1723.4	1818.4	3446.8	3636.8	672	1742.2	1837.2	3484.4	3674.4	766	1761.0	1856.0	3522.0	3712.0	859	1779.6	1874.6	3559.2	3749.2
579	1723.6	1818.6	3447.2	3637.2	673	1742.4	1837.4	3484.8	3674.8	767	1761.2	1856.2	3522.4	3712.4	860	1779.8	1874.8	3559.6	3749.6
580	1723.8	1818.8	3447.6	3637.6	674	1742.6	1837.6	3485.2	3675.2	768	1761.4	1856.4	3522.8	3712.8	861	1780.0	1875.0	3560.0	3750.0
581	1724.0	1819.0	3448.0	3638.0	675	1742.8	1837.8	3485.6	3675.6	769	1761.6	1856.6	3523.2	3713.2	862	1780.2	1875.2	3560.4	3750.4
582	1724.2	1819.2	3448.4	3638.4	676	1743.0	1838.0	3486.0	3676.0	770	1761.8	1856.8	3523.6	3713.6	863	1780.4	1875.4	3560.8	3750.8
583	1724.4	1819.4	3448.8	3638.8	677	1743.2	1838.2	3486.4	3676.4	771	1762.0	1857.0	3524.0	3714.0	864	1780.6	1875.6	3561.2	3751.2
584	1724.6	1819.6	3449.2	3639.2	678	1743.4	1838.4	3486.8	3676.8	772	1762.2	1857.2	3524.4	3714.4	865	1780.8	1875.8	3561.6	3751.6
585	1724.8	1819.8	3449.6	3639.6	679	1743.6	1838.6	3487.2	3677.2	773	1762.4	1857.4	3524.8	3714.8	866	1781.0	1876.0	3562.0	3752.0
586	1725.0	1820.0	3450.0	3640.0	680	1743.8	1838.8	3487.6	3677.6	774	1762.6	1857.6	3525.2	3715.2	867	1781.2	1876.2	3562.4	3752.4
587	1725.2	1820.2	3450.4	3640.4	681	1744.0	1839.0	3488.0	3678.0	775	1762.8	1857.8	3525.6	3715.6	868	1781.4	1876.4	3562.8	3752.8
588	1725.4	1820.4	3450.8	3640.8	682	1744.2	1839.2	3488.4	3678.4	776	1763.0	1858.0	3526.0	3716.0	869	1781.6	1876.6	3563.2	3753.2
589	1725.6	1820.6	3451.2	3641.2	683	1744.4	1839.4	3488.8	3678.8	777	1763.2	1858.2	3526.4	3716.4	870	1781.8	1876.8	3563.6	3753.6
590	1725.8	1820.8	3451.6	3641.6	684	1744.6	1839.6	3489.2	3679.2	778	1763.4	1858.4	3526.8	3716.8	871	1782.0	1877.0	3564.0	3754.0
591	1726.0	1821.0	3452.0	3642.0	685	1744.8	1839.8	3489.6	3679.6	779	1763.6	1858.6	3527.2	3717.2	872	1782.2	1877.2	3564.4	3754.4
592	1726.2	1821.2	3452.4	3642.4	686	1745.0	1840.0	3490.0	3680.0	780	1763.8	1858.8	3527.6	3717.6	873	1782.4	1877.4	3564.8	3754.8
593	1726.4	1821.4	3452.8	3642.8	687	1745.2	1840.2	3490.4	3680.4	781	1764.0	1859.0	3528.0	3718.0	874	1782.6	1877.6	3565.2	3755.2
594	1726.6	1821.6	3453.2	3643.2	688	1745.4	1840.4	3490.8	3680.8	782	1764.2	1859.2	3528.4	3718.4	875	1782.8	1877.8	3565.6	3755.6
595	1726.8	1821.8	3453.6	3643.6	689	1745.6	1840.6	3491.2	3681.2	783	1764.4	1859.4	3528.8	3718.8	876	1783.0	1878.0	3566.0	3756.0
596	1727.0	1822.0	3454.0	3644.0	690	1745.8	1840.8	3491.6	3681.6	784	1764.6	1859.6	3529.2	3719.2	877	1783.2	1878.2	3566.4	3756.4
597	1727.2	1822.2	3454.4	3644.4	691	1746.0	1841.0	3492.0	3682.0	785	1764.8	1859.8	3529.6	3719.6	878	1783.4	1878.4	3566.8	3756.8
598	1727.4	1822.4	3454.8	3644.8	692	1746.2	1841.2	3492.4	3682.4	786	1765.0	1860.0	3530.0	3720.0	879	1783.6	1878.6	3567.2	3757.2
599	1727.6	1822.6	3455.2	3645.2	693	1746.4	1841.4	3492.8	3682.8	787	1765.2	1860.2	3530.4	3720.4	880	1783.8	1878.8	3567.6	3757.6
600	1727.8	1822.8	3455.6	3645.6	694	1746.6	1841.6	3493.2	3683.2	788	1765.4	1860.4	3530.8	3720.8	881	1784.0	1879.0	3568.0	3758.0
601	1728.0	1823.0	3456.0	3646.0	695	1746.8	1841.8	3493.6	3683.6	789	1765.6	1860.6	3531.2	3721.2	882	1784.2	1879.2	3568.4	3758.4
602	1728.2	1823.2	3456.4	3646.4	696	1747.0	1842.0	3494.0	3684.0	790	1765.8	1860.8	3531.6	3721.6	883	1784.4	1879.4	3568.8	3758.8
603	1728.4	1823.4	3456.8	3646.8	697	1747.2	1842.2	3494.4	3684.4	791	1766.0	1861.0	3532.0	3722.0	884	1784.6	1879.6	3569.2	3759.2
604	1728.6	1823.6	3457.2	3647.2	698	1747.4	1842.4	3494.8	3684.8	792	1766.2	1861.2	3532.4	3722.4	885	1784.8	1879.8	3569.6	3759.6
605	1728.8	1823.8	3457.6	3647.6	699	1747.6	1842.6	3495.2	3685.2										

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GSM1900 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
512	1850,2	1930,2	3700,4	3860,4	606	1869,0	1949,0	3738,0	3898,0	700	1887,8	1967,8	3775,6	3935,6	794	1906,6	1986,6	3813,2	3973,2
513	1850,4	1930,4	3700,8	3860,8	607	1869,2	1949,2	3738,4	3898,4	701	1888,0	1968,0	3776,0	3936,0	795	1906,8	1986,8	3813,6	3973,6
514	1850,6	1930,6	3701,2	3861,2	608	1869,4	1949,4	3738,8	3898,8	702	1888,2	1968,2	3776,4	3936,4	796	1907,0	1987,0	3814,0	3974,0
515	1850,8	1930,8	3701,6	3861,6	609	1869,6	1949,6	3739,2	3899,2	703	1888,4	1968,4	3776,8	3936,8	797	1907,2	1987,2	3814,4	3974,4
516	1851,0	1931,0	3702,0	3862,0	610	1869,8	1949,8	3739,6	3899,6	704	1888,6	1968,6	3777,2	3937,2	798	1907,4	1987,4	3814,8	3974,8
517	1851,2	1931,2	3702,4	3862,4	611	1870,0	1950,0	3740,0	3900,0	705	1888,8	1968,8	3777,6	3937,6	799	1907,6	1987,6	3815,2	3975,2
518	1851,4	1931,4	3702,8	3862,8	612	1870,2	1950,2	3740,4	3900,4	706	1889,0	1969,0	3778,0	3938,0	800	1907,8	1987,8	3815,6	3975,6
519	1851,6	1931,6	3703,2	3863,2	613	1870,4	1950,4	3740,8	3900,8	707	1889,2	1969,2	3778,4	3938,4	801	1908,0	1988,0	3816,0	3976,0
520	1851,8	1931,8	3703,6	3863,6	614	1870,6	1950,6	3741,2	3901,2	708	1889,4	1969,4	3778,8	3938,8	802	1908,2	1988,2	3816,4	3976,4
521	1852,0	1932,0	3704,0	3864,0	615	1870,8	1950,8	3741,6	3901,6	709	1889,6	1969,6	3779,2	3939,2	803	1908,4	1988,4	3816,8	3976,8
522	1852,2	1932,2	3704,4	3864,4	616	1871,0	1951,0	3742,0	3902,0	710	1889,8	1969,8	3779,6	3939,6	804	1908,6	1988,6	3817,2	3977,2
523	1852,4	1932,4	3704,8	3864,8	617	1871,2	1951,2	3742,4	3902,4	711	1890,0	1970,0	3780,0	3940,0	805	1908,8	1988,8	3817,6	3977,6
524	1852,6	1932,6	3705,2	3865,2	618	1871,4	1951,4	3742,8	3902,8	712	1890,2	1970,2	3780,4	3940,4	806	1909,0	1989,0	3818,0	3978,0
525	1852,8	1932,8	3705,6	3865,6	619	1871,6	1951,6	3743,2	3903,2	713	1890,4	1970,4	3780,8	3940,8	807	1909,2	1989,2	3818,4	3978,4
526	1853,0	1933,0	3706,0	3866,0	620	1871,8	1951,8	3743,6	3903,6	714	1890,6	1970,6	3781,2	3941,2	808	1909,4	1989,4	3818,8	3978,8
527	1853,2	1933,2	3706,4	3866,4	621	1872,0	1952,0	3744,0	3904,0	715	1890,8	1970,8	3781,6	3941,6	809	1909,6	1989,6	3819,2	3979,2
528	1853,4	1933,4	3706,8	3866,8	622	1872,2	1952,2	3744,4	3904,4	716	1891,0	1971,0	3782,0	3942,0	810	1909,8	1989,8	3819,6	3979,6
529	1853,6	1933,6	3707,2	3867,2	623	1872,4	1952,4	3744,8	3904,8	717	1891,2	1971,2	3782,4	3942,4					
530	1853,8	1933,8	3707,6	3867,6	624	1872,6	1952,6	3745,2	3905,2	718	1891,4	1971,4	3782,8	3942,8					
531	1854,0	1934,0	3708,0	3868,0	625	1872,8	1952,8	3745,6	3905,6	719	1891,6	1971,6	3783,2	3943,2					
532	1854,2	1934,2	3708,4	3868,4	626	1873,0	1953,0	3746,0	3906,0	720	1891,8	1971,8	3783,6	3943,6					
533	1854,4	1934,4	3708,8	3868,8	627	1873,2	1953,2	3746,4	3906,4	721	1892,0	1972,0	3784,0	3944,0					
534	1854,6	1934,6	3709,2	3869,2	628	1873,4	1953,4	3746,8	3906,8	722	1892,2	1972,2	3784,4	3944,4					
535	1854,8	1934,8	3709,6	3869,6	629	1873,6	1953,6	3747,2	3907,2	723	1892,4	1972,4	3784,8	3944,8					
536	1855,0	1935,0	3710,0	3870,0	630	1873,8	1953,8	3747,6	3907,6	724	1892,6	1972,6	3785,2	3945,2					
537	1855,2	1935,2	3710,4	3870,4	631	1874,0	1954,0	3748,0	3908,0	725	1892,8	1972,8	3785,6	3945,6					
538	1855,4	1935,4	3710,8	3870,8	632	1874,2	1954,2	3748,4	3908,4	726	1893,0	1973,0	3786,0	3946,0					
539	1855,6	1935,6	3711,2	3871,2	633	1874,4	1954,4	3748,8	3908,8	727	1893,2	1973,2	3786,4	3946,4					
540	1855,8	1935,8	3711,6	3871,6	634	1874,6	1954,6	3749,2	3909,2	728	1893,4	1973,4	3786,8	3946,8					
541	1856,0	1936,0	3712,0	3872,0	635	1874,8	1954,8	3749,6	3909,6	729	1893,6	1973,6	3787,2	3947,2					
542	1856,2	1936,2	3712,4	3872,4	636	1875,0	1955,0	3750,0	3910,0	730	1893,8	1973,8	3787,6	3947,6					
543	1856,4	1936,4	3712,8	3872,8	637	1875,2	1955,2	3750,4	3910,4	731	1894,0	1974,0	3788,0	3948,0					
544	1856,6	1936,6	3713,2	3873,2	638	1875,4	1955,4	3750,8	3910,8	732	1894,2	1974,2	3788,4	3948,4					
545	1856,8	1936,8	3713,6	3873,6	639	1875,6	1955,6	3751,2	3911,2	733	1894,4	1974,4	3788,8	3948,8					
546	1857,0	1937,0	3714,0	3874,0	640	1875,8	1955,8	3751,6	3911,6	734	1894,6	1974,6	3789,2	3949,2					
547	1857,2	1937,2	3714,4	3874,4	641	1876,0	1956,0	3752,0	3912,0	735	1894,8	1974,8	3789,6	3949,6					
548	1857,4	1937,4	3714,8	3874,8	642	1876,2	1956,2	3752,4	3912,4	736	1895,0	1975,0	3790,0	3950,0					
549	1857,6	1937,6	3715,2	3875,2	643	1876,4	1956,4	3752,8	3912,8	737	1895,2	1975,2	3790,4	3950,4					
550	1857,8	1937,8	3715,6	3875,6	644	1876,6	1956,6	3753,2	3913,2	738	1895,4	1975,4	3790,8	3950,8					
551	1858,0	1938,0	3716,0	3876,0	645	1876,8	1956,8	3753,6	3913,6	739	1895,6	1975,6	3791,2	3951,2					
552	1858,2	1938,2	3716,4	3876,4	646	1877,0	1957,0	3754,0	3914,0	740	1895,8	1975,8	3791,6	3951,6					
553	1858,4	1938,4	3716,8	3876,8	647	1877,2	1957,2	3754,4	3914,4	741	1896,0	1976,0	3792,0	3952,0					
554	1858,6	1938,6	3717,2	3877,2	648	1877,4	1957,4	3754,8	3914,8	742	1896,2	1976,2	3792,4	3952,4					
555	1858,8	1938,8	3717,6	3877,6	649	1877,6	1957,6	3755,2	3915,2	743	1896,4	1976,4	3792,8	3952,8					
556	1859,0	1939,0	3718,0	3878,0	650	1877,8	1957,8	3755,6	3915,6	744	1896,6	1976,6	3793,2	3953,2					
557	1859,2	1939,2	3718,4	3878,4	651	1878,0	1958,0	3756,0	3916,0	745	1896,8	1976,8	3793,6	3953,6					
558	1859,4	1939,4	3718,8	3878,8	652	1878,2	1958,2	3756,4	3916,4	746	1897,0	1977,0	3794,0	3954,0					
559	1859,6	1939,6	3719,2	3879,2	653	1878,4	1958,4	3756,8	3916,8	747	1897,2	1977,2	3794,4	3954,4					
560	1859,8	1939,8	3719,6	3879,6	654	1878,6	1958,6	3757,2	3917,2	748	1897,4	1977,4	3794,8	3954,8					
561	1860,0	1940,0	3720,0	3880,0	655	1878,8	1958,8	3757,6	3917,6	749	1897,6	1977,6	3795,2	3955,2					
562	1860,2	1940,2	3720,4	3880,4	656	1879,0	1959,0	3758,0	3918,0	750	1897,8	1977,8	3795,6	3955,6					
563	1860,4	1940,4	3720,8	3880,8	657	1879,2	1959,2	3758,4	3918,4	751	1898,0	1978,0	3796,0	3956,0					
564	1860,6	1940,6	3721,2	3881,2	658	1879,4	1959,4	3758,8	3918,8	752	1898,2	1978,2	3796,4	3956,4					
565	1860,8	1940,8	3721,6	3881,6	659	1879,6	1959,6	3759,2	3919,2	753	1898,4	1978,4	3796,8	3956,8					
566	1861,0	1941,0	3722,0	3882,0	660	1879,8	1959,8	3759,6	3919,6	754	1898,6	1978,6	3797,2	3957,2					
567	1861,2	1941,2	3722,4	3882,4	661	1880,0	1960,0	3760,0	3920,0	755	1898,8	1978,8	3797,6	3957,6					
568	1861,4	1941,4	3722,8	3882,8	662	1880,2	1960,2	3760,4	3920,4	756	1899,0	1979,0	3798,0	3958,0					
569	1861,6	1941,6	3723,2	3883,2	663	1880,4	1960,4	3760,8	3920,8	757	1899,2	1979,2	3798,4	3958,4					
570	1861,8	1941,8	3723,6	3883,6	664	1880,6	1960,6	3761,2	3921,2	758	1899,4	1979,4	3798,8	3958,8					
571	1862,0	1942,0	3724,0	3884,0	665	1880,8	1960,8	3761,6	3921,6	759	1899,6	1979,6	3799,2	3959,2					
572	1862,2	1942,2	3724,4	3884,4	666	1881,0	1961,0	3762,0	3922,0	760	1899,8	1979,8	3799,6	3959,6					
573	1862,4	1942,4	3724,8	3884,8	667	1881,2	1961,2	3762,4	3922,4	761	1900,0	1980,0	3800,0	3960,0					
574	1862,6	1942,6	3725,2	3885,2	668	1881,4	1961,4	3762,8	3922,8	762	1900,2	1980,2	3800,4	3960,4					
575	1862,8	1942,8	3725,6	3885,6	669	1881,6	1961,6	3763,2	3923,2	763	1900,4	1980,4	3800,8	3960,8					
576	1863,0	1943,0	3726,0	3886,0	670	1881,8	1961,8	3763,6	3923,6	764	1900,6	1980,6	3801,2	3961,2					
577	1863,2	1943,2	3726,4	3886,4	671	1882,0	1962,0	3764,0	3924,0	765	1900,8	1980,8	3801,6	3961,6					
578	1863,4	1943,4	3726,8	3886,8	672	1882,2	1962,2	3764,4	3924,4	766	1901,0	1981,0	3802,0	3962,0					
579	1863,6	1943,6	3727,2	3887,2	673	1882,4	1962,4	3764,8	3924,8	767	1901,2	1981,2	3802,4	3962,4					
580	1863,8	1943,8	3727,6	3887,6	674	1882,6	1962,6	3765,2	3925,2	768	1901,4	1981,4	3802,8	3962,8					
581	1864,0	1944,0	3728,0	3888,0	675	1882,8	1962,8	3765,6	3925,6	769	1901,6	1981,6	3803,2	3963,2					
582	1864,2	1944,2	3728,4	3888,4	676	1883,0	1963,0	3766,0	3926,0	770	1901,8	1981,8	3803,6	3963,6					
583	1864,4	1944,4	3728,8	3888,8	677	1883,2	1963,2	3766,4	3926,4	771	1902,0	1982,0	3804,0	3964,0					
584	1864,6	1944,6	3729,2	3889,2	678	1883,4	1963,4	3766,8	3926,8	772	1902,2	1982,2	3804,4	3964,4					
585	1864,8	1944,8	3729,6	3889,6	679	1883,6	1963,6	3767,2	3927,2	773	1902,4	1982,4	3804,8	3964,8					
586	1865,0	1945,0	3730,0	3890,0	680	1883,8	1963,8	3767,6	3927,6	774	1902,6	1982,6	3805,2	3965,2					
587	1865,2	1945,2	3730,4	3890,4	681	1884,0	1964,0	3768,0	3928,0	775	1902,8	1982,8	3805,6	3965,6					
588	1865,4	1945,4	3730,8	3890,8	682	1884,2	1964,2	3768,4	3928,4	776	1903,0	1983,0	3806,0	3966,0					
589	1865,6	1945,6	3731,2	3891,2	683	1884,4	1964,4	3768,8	3928,8	777	1903,2	1983,2	3806,4	3966,4					
590	1865,8	1945,8	3731,6	3891,6	684	1884,6	1964,6	3769,2	3929,2	778	1903,4	1983,4	3806,8	3966,8					
591	1866,0	1946,0	3732,0	3892,0	685	1884,8	1964,8	3769,6	3929,6	779	1903,6	1983,6	3807,2	3967,2					
592	1866,2	1946,2	3732,4	3892,4	686	1885,0	1965,0	3770,0	3930,0	780	1903,8	1983,8	3807,6	3967,6					
593	1866,4	1946,4	3732,8	3892,8	687	1885,2	1965,2	3770,4	3930,4	781	1904,0	1984,0	3808,0	3968,0					
594	1866,6	1946,6	3733,2	3893,2	688	1885,4	1965,4	3770,8	3930,8	782	1904,2	1984,2	3808,4	3968,4					
595	1866,8	1946,8	3733,6	3893,6	689	1885,6	1965,6	3771,2	3931,2	783	1904,4	1984,4	3808,8	3968,8					
596	1867,0	1947,0	3734,0	3894,0	690	1885,8	1965,8	3771,6	3931,6	784	1904,6	1984,6	3809,2	3969,2					
597	1867,2	1947,2	3734,4	3894,4	691	1886,0	1966,0	3772,0	3932,0	785	1904,8	1984,8	3809,6	3969,6					
598	1867,4	1947,4	3734,8	3894,8	692	1886,2	1966,2	3772,4	3932,4	786	1905,0	1985,0	3810,0	3970,0					
599	1867,6	1947,6	3735,2	3895,2	693	1886,4	1966,4	3772,8	3932,8	787	1905,2	1985,2	3810,4	3970,4					
600	1867,8	1947,8	3735,6	3895,6	694	1886,6	1966,6	3773,2	3933,2	788	1905,4	1985,4	3810,8	3970,8					
601	1868,0	1948,0	3736,0	3896,0	695	1886,8	1966,8	3773,6	3933,6	789	1905,6	1985,6	3811,2	3971,2					
602	1868,2	1948,2	3736,4	3896,4	696	1887,0	1967,0	3774,0	3934,0	790	1905,8	1985,8	3811,6	3971,6					
603	1868,4	1948,4	3736,8	3896,8	697	1887,2	1967,2	3774,4	3934,4	791	1906,0	1986,0	3812,0	3972,0					
604	1868,6	1948,6	3737,2	3897,2	698	1887,4	1967,4	3774,8	3934,8	792	1906,2	1986,2	3812,4	3972,4					
605	1868,8	1948,8	3737,6	3897,6	699	1887,6	1967,6	3775,2	3935,2	793	1906,4	1986,4	3812,8	3972,8					

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WCDMA 2100 Rx frequencies

Ch	RX	VCO RX	Ch	RX	VCO RX	Ch	RX	VCO RX	Ch	RX	VCO RX	Ch	RX	VCO RX
10562	2112.4	4224.8	10625	2125	4250	10688	2137.6	4275.2	10751	2150.2	4300.4	10814	2162.8	4325.6
10563	2112.6	4225.2	10626	2125.2	4250.4	10689	2137.8	4275.6	10752	2150.4	4300.8	10815	2163	4326
10564	2112.8	4225.6	10627	2125.4	4250.8	10690	2138	4276	10753	2150.6	4301.2	10816	2163.2	4326.4
10565	2113	4226	10628	2125.6	4251.2	10691	2138.2	4276.4	10754	2150.8	4301.6	10817	2163.4	4326.8
10566	2113.2	4226.4	10629	2125.8	4251.6	10692	2138.4	4276.8	10755	2151	4302	10818	2163.6	4327.2
10567	2113.4	4226.8	10630	2126	4252	10693	2138.6	4277.2	10756	2151.2	4302.4	10819	2163.8	4327.6
10568	2113.6	4227.2	10631	2126.2	4252.4	10694	2138.8	4277.6	10757	2151.4	4302.8	10820	2164	4328
10569	2113.8	4227.6	10632	2126.4	4252.8	10695	2139	4278	10758	2151.6	4303.2	10821	2164.2	4328.4
10570	2114	4228	10633	2126.6	4253.2	10696	2139.2	4278.4	10759	2151.8	4303.6	10822	2164.4	4328.8
10571	2114.2	4228.4	10634	2126.8	4253.6	10697	2139.4	4278.8	10760	2152	4304	10823	2164.6	4329.2
10572	2114.4	4228.8	10635	2127	4254	10698	2139.6	4279.2	10761	2152.2	4304.4	10824	2164.8	4329.6
10573	2114.6	4229.2	10636	2127.2	4254.4	10699	2139.8	4279.6	10762	2152.4	4304.8	10825	2165	4330
10574	2114.8	4229.6	10637	2127.4	4254.8	10700	2140	4280	10763	2152.6	4305.2	10826	2165.2	4330.4
10575	2115	4230	10638	2127.6	4255.2	10701	2140.2	4280.4	10764	2152.8	4305.6	10827	2165.4	4330.8
10576	2115.2	4230.4	10639	2127.8	4255.6	10702	2140.4	4280.8	10765	2153	4306	10828	2165.6	4331.2
10577	2115.4	4230.8	10640	2128	4256	10703	2140.6	4281.2	10766	2153.2	4306.4	10829	2165.8	4331.6
10578	2115.6	4231.2	10641	2128.2	4256.4	10704	2140.8	4281.6	10767	2153.4	4306.8	10830	2166	4332
10579	2115.8	4231.6	10642	2128.4	4256.8	10705	2141	4282	10768	2153.6	4307.2	10831	2166.2	4332.4
10580	2116	4232	10643	2128.6	4257.2	10706	2141.2	4282.4	10769	2153.8	4307.6	10832	2166.4	4332.8
10581	2116.2	4232.4	10644	2128.8	4257.6	10707	2141.4	4282.8	10770	2154	4308	10833	2166.6	4333.2
10582	2116.4	4232.8	10645	2129	4258	10708	2141.6	4283.2	10771	2154.2	4308.4	10834	2166.8	4333.6
10583	2116.6	4233.2	10646	2129.2	4258.4	10709	2141.8	4283.6	10772	2154.4	4308.8	10835	2167	4334
10584	2116.8	4233.6	10647	2129.4	4258.8	10710	2142	4284	10773	2154.6	4309.2	10836	2167.2	4334.4
10585	2117	4234	10648	2129.6	4259.2	10711	2142.2	4284.4	10774	2154.8	4309.6	10837	2167.4	4334.8
10586	2117.2	4234.4	10649	2129.8	4259.6	10712	2142.4	4284.8	10775	2155	4310	10838	2167.6	4335.2
10587	2117.4	4234.8	10650	2130	4260	10713	2142.6	4285.2	10776	2155.2	4310.4			
10588	2117.6	4235.2	10651	2130.2	4260.4	10714	2142.8	4285.6	10777	2155.4	4310.8			
10589	2117.8	4235.6	10652	2130.4	4260.8	10715	2143	4286	10778	2155.6	4311.2			
10590	2118	4236	10653	2130.6	4261.2	10716	2143.2	4286.4	10779	2155.8	4311.6			
10591	2118.2	4236.4	10654	2130.8	4261.6	10717	2143.4	4286.8	10780	2156	4312			
10592	2118.4	4236.8	10655	2131	4262	10718	2143.6	4287.2	10781	2156.2	4312.4			
10593	2118.6	4237.2	10656	2131.2	4262.4	10719	2143.8	4287.6	10782	2156.4	4312.8			
10594	2118.8	4237.6	10657	2131.4	4262.8	10720	2144	4288	10783	2156.6	4313.2			
10595	2119	4238	10658	2131.6	4263.2	10721	2144.2	4288.4	10784	2156.8	4313.6			
10596	2119.2	4238.4	10659	2131.8	4263.6	10722	2144.4	4288.8	10785	2157	4314			
10597	2119.4	4238.8	10660	2132	4264	10723	2144.6	4289.2	10786	2157.2	4314.4			
10598	2119.6	4239.2	10661	2132.2	4264.4	10724	2144.8	4289.6	10787	2157.4	4314.8			
10599	2119.8	4239.6	10662	2132.4	4264.8	10725	2145	4290	10788	2157.6	4315.2			
10600	2120	4240	10663	2132.6	4265.2	10726	2145.2	4290.4	10789	2157.8	4315.6			
10601	2120.2	4240.4	10664	2132.8	4265.6	10727	2145.4	4290.8	10790	2158	4316			
10602	2120.4	4240.8	10665	2133	4266	10728	2145.6	4291.2	10791	2158.2	4316.4			
10603	2120.6	4241.2	10666	2133.2	4266.4	10729	2145.8	4291.6	10792	2158.4	4316.8			
10604	2120.8	4241.6	10667	2133.4	4266.8	10730	2146	4292	10793	2158.6	4317.2			
10605	2121	4242	10668	2133.6	4267.2	10731	2146.2	4292.4	10794	2158.8	4317.6			
10606	2121.2	4242.4	10669	2133.8	4267.6	10732	2146.4	4292.8	10795	2159	4318			
10607	2121.4	4242.8	10670	2134	4268	10733	2146.6	4293.2	10796	2159.2	4318.4			
10608	2121.6	4243.2	10671	2134.2	4268.4	10734	2146.8	4293.6	10797	2159.4	4318.8			
10609	2121.8	4243.6	10672	2134.4	4268.8	10735	2147	4294	10798	2159.6	4319.2			
10610	2122	4244	10673	2134.6	4269.2	10736	2147.2	4294.4	10799	2159.8	4319.6			
10611	2122.2	4244.4	10674	2134.8	4269.6	10737	2147.4	4294.8	10800	2160	4320			
10612	2122.4	4244.8	10675	2135	4270	10738	2147.6	4295.2	10801	2160.2	4320.4			
10613	2122.6	4245.2	10676	2135.2	4270.4	10739	2147.8	4295.6	10802	2160.4	4320.8			
10614	2122.8	4245.6	10677	2135.4	4270.8	10740	2148	4296	10803	2160.6	4321.2			
10615	2123	4246	10678	2135.6	4271.2	10741	2148.2	4296.4	10804	2160.8	4321.6			
10616	2123.2	4246.4	10679	2135.8	4271.6	10742	2148.4	4296.8	10805	2161	4322			
10617	2123.4	4246.8	10680	2136	4272	10743	2148.6	4297.2	10806	2161.2	4322.4			
10618	2123.6	4247.2	10681	2136.2	4272.4	10744	2148.8	4297.6	10807	2161.4	4322.8			
10619	2123.8	4247.6	10682	2136.4	4272.8	10745	2149	4298	10808	2161.6	4323.2			
10620	2124	4248	10683	2136.6	4273.2	10746	2149.2	4298.4	10809	2161.8	4323.6			
10621	2124.2	4248.4	10684	2136.8	4273.6	10747	2149.4	4298.8	10810	2162	4324			
10622	2124.4	4248.8	10685	2137	4274	10748	2149.6	4299.2	10811	2162.2	4324.4			
10623	2124.6	4249.2	10686	2137.2	4274.4	10749	2149.8	4299.6	10812	2162.4	4324.8			
10624	2124.8	4249.6	10687	2137.4	4274.8	10750	2150	4300	10813	2162.6	4325.2			

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WCDMA 2100 Tx frequencies

Ch	Tx	VCO Tx	Ch	Tx	VCO Tx	Ch	Tx	VCO Tx	Ch	Tx	VCO Tx	Ch	Tx	VCO Tx
9612	1922.4	3844.8	9671	1934.2	3868.4	9730	1946	3892	9789	1957.8	3915.6	9848	1969.6	3939.2
9613	1922.6	3845.2	9672	1934.4	3868.8	9731	1946.2	3892.4	9790	1958	3916	9849	1969.8	3939.6
9614	1922.8	3845.6	9673	1934.6	3869.2	9732	1946.4	3892.8	9791	1958.2	3916.4	9850	1970	3940
9615	1923	3846	9674	1934.8	3869.6	9733	1946.6	3893.2	9792	1958.4	3916.8	9851	1970.2	3940.4
9616	1923.2	3846.4	9675	1935	3870	9734	1946.8	3893.6	9793	1958.6	3917.2	9852	1970.4	3940.8
9617	1923.4	3846.8	9676	1935.2	3870.4	9735	1947	3894	9794	1958.8	3917.6	9853	1970.6	3941.2
9618	1923.6	3847.2	9677	1935.4	3870.8	9736	1947.2	3894.4	9795	1959	3918	9854	1970.8	3941.6
9619	1923.8	3847.6	9678	1935.6	3871.2	9737	1947.4	3894.8	9796	1959.2	3918.4	9855	1971	3942
9620	1924	3848	9679	1935.8	3871.6	9738	1947.6	3895.2	9797	1959.4	3918.8	9856	1971.2	3942.4
9621	1924.2	3848.4	9680	1936	3872	9739	1947.8	3895.6	9798	1959.6	3919.2	9857	1971.4	3942.8
9622	1924.4	3848.8	9681	1936.2	3872.4	9740	1948	3896	9799	1959.8	3919.6	9858	1971.6	3943.2
9623	1924.6	3849.2	9682	1936.4	3872.8	9741	1948.2	3896.4	9800	1960	3920	9859	1971.8	3943.6
9624	1924.8	3849.6	9683	1936.6	3873.2	9742	1948.4	3896.8	9801	1960.2	3920.4	9860	1972	3944
9625	1925	3850	9684	1936.8	3873.6	9743	1948.6	3897.2	9802	1960.4	3920.8	9861	1972.2	3944.4
9626	1925.2	3850.4	9685	1937	3874	9744	1948.8	3897.6	9803	1960.6	3921.2	9862	1972.4	3944.8
9627	1925.4	3850.8	9686	1937.2	3874.4	9745	1949	3898	9804	1960.8	3921.6	9863	1972.6	3945.2
9628	1925.6	3851.2	9687	1937.4	3874.8	9746	1949.2	3898.4	9805	1961	3922	9864	1972.8	3945.6
9629	1925.8	3851.6	9688	1937.6	3875.2	9747	1949.4	3898.8	9806	1961.2	3922.4	9865	1973	3946
9630	1926	3852	9689	1937.8	3875.6	9748	1949.6	3899.2	9807	1961.4	3922.8	9866	1973.2	3946.4
9631	1926.2	3852.4	9690	1938	3876	9749	1949.8	3899.6	9808	1961.6	3923.2	9867	1973.4	3946.8
9632	1926.4	3852.8	9691	1938.2	3876.4	9750	1950	3900	9809	1961.8	3923.6	9868	1973.6	3947.2
9633	1926.6	3853.2	9692	1938.4	3876.8	9751	1950.2	3900.4	9810	1962	3924	9869	1973.8	3947.6
9634	1926.8	3853.6	9693	1938.6	3877.2	9752	1950.4	3900.8	9811	1962.2	3924.4	9870	1974	3948
9635	1927	3854	9694	1938.8	3877.6	9753	1950.6	3901.2	9812	1962.4	3924.8	9871	1974.2	3948.4
9636	1927.2	3854.4	9695	1939	3878	9754	1950.8	3901.6	9813	1962.6	3925.2	9872	1974.4	3948.8
9637	1927.4	3854.8	9696	1939.2	3878.4	9755	1951	3902	9814	1962.8	3925.6	9873	1974.6	3949.2
9638	1927.6	3855.2	9697	1939.4	3878.8	9756	1951.2	3902.4	9815	1963	3926	9874	1974.8	3949.6
9639	1927.8	3855.6	9698	1939.6	3879.2	9757	1951.4	3902.8	9816	1963.2	3926.4	9875	1975	3950
9640	1928	3856	9699	1939.8	3879.6	9758	1951.6	3903.2	9817	1963.4	3926.8	9876	1975.2	3950.4
9641	1928.2	3856.4	9700	1940	3880	9759	1951.8	3903.6	9818	1963.6	3927.2	9877	1975.4	3950.8
9642	1928.4	3856.8	9701	1940.2	3880.4	9760	1952	3904	9819	1963.8	3927.6	9878	1975.6	3951.2
9643	1928.6	3857.2	9702	1940.4	3880.8	9761	1952.2	3904.4	9820	1964	3928	9879	1975.8	3951.6
9644	1928.8	3857.6	9703	1940.6	3881.2	9762	1952.4	3904.8	9821	1964.2	3928.4	9880	1976	3952
9645	1929	3858	9704	1940.8	3881.6	9763	1952.6	3905.2	9822	1964.4	3928.8	9881	1976.2	3952.4
9646	1929.2	3858.4	9705	1941	3882	9764	1952.8	3905.6	9823	1964.6	3929.2	9882	1976.4	3952.8
9647	1929.4	3858.8	9706	1941.2	3882.4	9765	1953	3906	9824	1964.8	3929.6	9883	1976.6	3953.2
9648	1929.6	3859.2	9707	1941.4	3882.8	9766	1953.2	3906.4	9825	1965	3930	9884	1976.8	3953.6
9649	1929.8	3859.6	9708	1941.6	3883.2	9767	1953.4	3906.8	9826	1965.2	3930.4	9885	1977	3954
9650	1930	3860	9709	1941.8	3883.6	9768	1953.6	3907.2	9827	1965.4	3930.8	9886	1977.2	3954.4
9651	1930.2	3860.4	9710	1942	3884	9769	1953.8	3907.6	9828	1965.6	3931.2	9887	1977.4	3954.8
9652	1930.4	3860.8	9711	1942.2	3884.4	9770	1954	3908	9829	1965.8	3931.6	9888	1977.6	3955.2
9653	1930.6	3861.2	9712	1942.4	3884.8	9771	1954.2	3908.4	9830	1966	3932			
9654	1930.8	3861.6	9713	1942.6	3885.2	9772	1954.4	3908.8	9831	1966.2	3932.4			
9655	1931	3862	9714	1942.8	3885.6	9773	1954.6	3909.2	9832	1966.4	3932.8			
9656	1931.2	3862.4	9715	1943	3886	9774	1954.8	3909.6	9833	1966.6	3933.2			
9657	1931.4	3862.8	9716	1943.2	3886.4	9775	1955	3910	9834	1966.8	3933.6			
9658	1931.6	3863.2	9717	1943.4	3886.8	9776	1955.2	3910.4	9835	1967	3934			
9659	1931.8	3863.6	9718	1943.6	3887.2	9777	1955.4	3910.8	9836	1967.2	3934.4			
9660	1932	3864	9719	1943.8	3887.6	9778	1955.6	3911.2	9837	1967.4	3934.8			
9661	1932.2	3864.4	9720	1944	3888	9779	1955.8	3911.6	9838	1967.6	3935.2			
9662	1932.4	3864.8	9721	1944.2	3888.4	9780	1956	3912	9839	1967.8	3935.6			
9663	1932.6	3865.2	9722	1944.4	3888.8	9781	1956.2	3912.4	9840	1968	3936			
9664	1932.8	3865.6	9723	1944.6	3889.2	9782	1956.4	3912.8	9841	1968.2	3936.4			
9665	1933	3866	9724	1944.8	3889.6	9783	1956.6	3913.2	9842	1968.4	3936.8			
9666	1933.2	3866.4	9725	1945	3890	9784	1956.8	3913.6	9843	1968.6	3937.2			
9667	1933.4	3866.8	9726	1945.2	3890.4	9785	1957	3914	9844	1968.8	3937.6			
9668	1933.6	3867.2	9727	1945.4	3890.8	9786	1957.2	3914.4	9845	1969	3938			
9669	1933.8	3867.6	9728	1945.6	3891.2	9787	1957.4	3914.8	9846	1969.2	3938.4			
9670	1934	3868	9729	1945.8	3891.6	9788	1957.6	3915.2	9847	1969.4	3938.8			

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WCDMA V (850) frequencies

TX CH	RX CH	TX	RX	VCO TX	VCO RX
4132	4357	826.4	871.4	3305.6	3485.6
782	1007	826.5	871.5	3306.0	3486.0
4133	4358	826.6	871.6	3306.4	3486.4
4134	4359	826.8	871.8	3307.2	3487.2
4135	4360	827.0	872.0	3308.0	3488.0
4136	4361	827.2	872.2	3308.8	3488.8
4137	4362	827.4	872.4	3309.6	3489.6
787	1012	827.5	872.5	3310.0	3490.0
4138	4363	827.6	872.6	3310.4	3490.4
4139	4364	827.8	872.8	3311.2	3491.2
4140	4365	828.0	873.0	3312.0	3492.0
4141	4366	828.2	873.2	3312.8	3492.8
4142	4367	828.4	873.4	3313.6	3493.6
4143	4368	828.6	873.6	3314.4	3494.4
4144	4369	828.8	873.8	3315.2	3495.2
4145	4370	829.0	874.0	3316.0	3496.0
4146	4371	829.2	874.2	3316.8	3496.8
4147	4372	829.4	874.4	3317.6	3497.6
4148	4373	829.6	874.6	3318.4	3498.4
4149	4374	829.8	874.8	3319.2	3499.2
4150	4375	830.0	875.0	3320.0	3500.0
4151	4376	830.2	875.2	3320.8	3500.8
4152	4377	830.4	875.4	3321.6	3501.6
4153	4378	830.6	875.6	3322.4	3502.4
4154	4379	830.8	875.8	3323.2	3503.2
4155	4380	831.0	876.0	3324.0	3504.0
4156	4381	831.2	876.2	3324.8	3504.8
4157	4382	831.4	876.4	3325.6	3505.6
807	1032	831.5	876.5	3326.0	3506.0
4158	4383	831.6	876.6	3326.4	3506.4
4159	4384	831.8	876.8	3327.2	3507.2
4160	4385	832.0	877.0	3328.0	3508.0
4161	4386	832.2	877.2	3328.8	3508.8
4162	4387	832.4	877.4	3329.6	3509.6
812	1037	832.5	877.5	3330.0	3510.0
4163	4388	832.6	877.6	3330.4	3510.4
4164	4389	832.8	877.8	3331.2	3511.2
4165	4390	833.0	878.0	3332.0	3512.0
4166	4391	833.2	878.2	3332.8	3512.8
4167	4392	833.4	878.4	3333.6	3513.6
4168	4393	833.6	878.6	3334.4	3514.4
4169	4394	833.8	878.8	3335.2	3515.2
4170	4395	834.0	879.0	3336.0	3516.0
4171	4396	834.2	879.2	3336.8	3516.8
4172	4397	834.4	879.4	3337.6	3517.6
4173	4398	834.6	879.6	3338.4	3518.4
4174	4399	834.8	879.8	3339.2	3519.2
4175	4400	835.0	880.0	3340.0	3520.0
4176	4401	835.2	880.2	3340.8	3520.8
4177	4402	835.4	880.4	3341.6	3521.6
4178	4403	835.6	880.6	3342.4	3522.4
4179	4404	835.8	880.8	3343.2	3523.2
4180	4405	836.0	881.0	3344.0	3524.0
4181	4406	836.2	881.2	3344.8	3524.8

TX CH	RX CH	TX	RX	VCO TX	VCO RX
4182	4407	836.4	881.4	3345.6	3525.6
4183	4408	836.6	881.6	3346.4	3526.4
4184	4409	836.8	881.8	3347.2	3527.2
4185	4410	837.0	882.0	3348.0	3528.0
4186	4411	837.2	882.2	3348.8	3528.8
4187	4412	837.4	882.4	3349.6	3529.6
837	1062	837.5	882.5	3350.0	3530.0
4188	4413	837.6	882.6	3350.4	3530.4
4189	4414	837.8	882.8	3351.2	3531.2
4190	4415	838.0	883.0	3352.0	3532.0
4191	4416	838.2	883.2	3352.8	3532.8
4192	4417	838.4	883.4	3353.6	3533.6
4193	4418	838.6	883.6	3354.4	3534.4
4194	4419	838.8	883.8	3355.2	3535.2
4195	4420	839.0	884.0	3356.0	3536.0
4196	4421	839.2	884.2	3356.8	3536.8
4197	4422	839.4	884.4	3357.6	3537.6
4198	4423	839.6	884.6	3358.4	3538.4
4199	4424	839.8	884.8	3359.2	3539.2
4200	4425	840.0	885.0	3360.0	3540.0
4201	4426	840.2	885.2	3360.8	3540.8
4202	4427	840.4	885.4	3361.6	3541.6
4203	4428	840.6	885.6	3362.4	3542.4
4204	4429	840.8	885.8	3363.2	3543.2
4205	4430	841.0	886.0	3364.0	3544.0
4206	4431	841.2	886.2	3364.8	3544.8
4207	4432	841.4	886.4	3365.6	3545.6
4208	4433	841.6	886.6	3366.4	3546.4
4209	4434	841.8	886.8	3367.2	3547.2
4210	4435	842.0	887.0	3368.0	3548.0
4211	4436	842.2	887.2	3368.8	3548.8
4212	4437	842.4	887.4	3369.6	3549.6
862	1087	842.5	887.5	3370.0	3550.0
4213	4438	842.6	887.6	3370.4	3550.4
4214	4439	842.8	887.8	3371.2	3551.2
4215	4440	843.0	888.0	3372.0	3552.0
4216	4441	843.2	888.2	3372.8	3552.8
4217	4442	843.4	888.4	3373.6	3553.6
4218	4443	843.6	888.6	3374.4	3554.4
4219	4444	843.8	888.8	3375.2	3555.2
4220	4445	844.0	889.0	3376.0	3556.0
4221	4446	844.2	889.2	3376.8	3556.8
4222	4447	844.4	889.4	3377.6	3557.6
4223	4448	844.6	889.6	3378.4	3558.4
4224	4449	844.8	889.8	3379.2	3559.2
4225	4450	845.0	890.0	3380.0	3560.0
4226	4451	845.2	890.2	3380.8	3560.8
4227	4452	845.4	890.4	3381.6	3561.6
4228	4453	845.6	890.6	3382.4	3562.4
4229	4454	845.8	890.8	3383.2	3563.2
4230	4455	846.0	891.0	3384.0	3564.0
4231	4456	846.2	891.2	3384.8	3564.8
4232	4457	846.4	891.4	3385.6	3565.6
4233	4458	846.6	891.6	3386.4	3566.4

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WCDMA VIII (900) frequencies

Uplink CH (TX)	Freq (MHz)	VCO (MHz)	Downlink CH (RX)	Freq (MHz)	VCO (MHz)
2712	882,4	3529,6	2937	927,4	3709,6
2713	882,6	3530,4	2938	927,6	3710,4
2714	882,8	3531,2	2939	927,8	3711,2
2715	883	3532	2940	928	3712
2716	883,2	3532,8	2941	928,2	3712,8
2717	883,4	3533,6	2942	928,4	3713,6
2718	883,6	3534,4	2943	928,6	3714,4
2719	883,8	3535,2	2944	928,8	3715,2
2720	884	3536	2945	929	3716
2721	884,2	3536,8	2946	929,2	3716,8
2722	884,4	3537,6	2947	929,4	3717,6
2723	884,6	3538,4	2948	929,6	3718,4
2724	884,8	3539,2	2949	929,8	3719,2
2725	885	3540	2950	930	3720
2726	885,2	3540,8	2951	930,2	3720,8
2727	885,4	3541,6	2952	930,4	3721,6
2728	885,6	3542,4	2953	930,6	3722,4
2729	885,8	3543,2	2954	930,8	3723,2
2730	886	3544	2955	931	3724
2731	886,2	3544,8	2956	931,2	3724,8
2732	886,4	3545,6	2957	931,4	3725,6
2733	886,6	3546,4	2958	931,6	3726,4
2734	886,8	3547,2	2959	931,8	3727,2
2735	887	3548	2960	932	3728
2736	887,2	3548,8	2961	932,2	3728,8
2737	887,4	3549,6	2962	932,4	3729,6
2738	887,6	3550,4	2963	932,6	3730,4
2739	887,8	3551,2	2964	932,8	3731,2
2740	888	3552	2965	933	3732
2741	888,2	3552,8	2966	933,2	3732,8
2742	888,4	3553,6	2967	933,4	3733,6
2743	888,6	3554,4	2968	933,6	3734,4
2744	888,8	3555,2	2969	933,8	3735,2

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Uplink CH (TX)	Freq (MHz)	VCO (MHz)	Downlink CH (RX)	Freq (MHz)	VCO (MHz)
2745	889	3556	2970	934	3736
2746	889,2	3556,8	2971	934,2	3736,8
2747	889,4	3557,6	2972	934,4	3737,6
2748	889,6	3558,4	2973	934,6	3738,4
2749	889,8	3559,2	2974	934,8	3739,2
2750	890	3560	2975	935	3740
2751	890,2	3560,8	2976	935,2	3740,8
2752	890,4	3561,6	2977	935,4	3741,6
2753	890,6	3562,4	2978	935,6	3742,4
2754	890,8	3563,2	2979	935,8	3743,2
2755	891	3564	2980	936	3744
2756	891,2	3564,8	2981	936,2	3744,8
2757	891,4	3565,6	2982	936,4	3745,6
2758	891,6	3566,4	2983	936,6	3746,4
2759	891,8	3567,2	2984	936,8	3747,2
2760	892	3568	2985	937	3748
2761	892,2	3568,8	2986	937,2	3748,8
2762	892,4	3569,6	2987	937,4	3749,6
2763	892,6	3570,4	2988	937,6	3750,4
2764	892,8	3571,2	2989	937,8	3751,2
2765	893	3572	2990	938	3752
2766	893,2	3572,8	2991	938,2	3752,8
2767	893,4	3573,6	2992	938,4	3753,6
2768	893,6	3574,4	2993	938,6	3754,4
2769	893,8	3575,2	2994	938,8	3755,2
2770	894	3576	2995	939	3756
2771	894,2	3576,8	2996	939,2	3756,8
2772	894,4	3577,6	2997	939,4	3757,6
2773	894,6	3578,4	2998	939,6	3758,4
2774	894,8	3579,2	2999	939,8	3759,2
2775	895	3580	3000	940	3760
2776	895,2	3580,8	3001	940,2	3760,8
2777	895,4	3581,6	3002	940,4	3761,6
2778	895,6	3582,4	3003	940,6	3762,4
2779	895,8	3583,2	3004	940,8	3763,2

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Uplink CH (TX)	Freq (MHz)	VCO (MHz)	Downlink CH (RX)	Freq (MHz)	VCO (MHz)
2780	896	3584	3005	941	3764
2781	896,2	3584,8	3006	941,2	3764,8
2782	896,4	3585,6	3007	941,4	3765,6
2783	896,6	3586,4	3008	941,6	3766,4
2784	896,8	3587,2	3009	941,8	3767,2
2785	897	3588	3010	942	3768
2786	897,2	3588,8	3011	942,2	3768,8
2787	897,4	3589,6	3012	942,4	3769,6
2788	897,6	3590,4	3013	942,6	3770,4
2789	897,8	3591,2	3014	942,8	3771,2
2790	898	3592	3015	943	3772
2791	898,2	3592,8	3016	943,2	3772,8
2792	898,4	3593,6	3017	943,4	3773,6
2793	898,6	3594,4	3018	943,6	3774,4
2794	898,8	3595,2	3019	943,8	3775,2
2795	899	3596	3020	944	3776
2796	899,2	3596,8	3021	944,2	3776,8
2797	899,4	3597,6	3022	944,4	3777,6
2798	899,6	3598,4	3023	944,6	3778,4
2799	899,8	3599,2	3024	944,8	3779,2
2800	900	3600	3025	945	3780
2801	900,2	3600,8	3026	945,2	3780,8
2802	900,4	3601,6	3027	945,4	3781,6
2803	900,6	3602,4	3028	945,6	3782,4
2804	900,8	3603,2	3029	945,8	3783,2
2805	901	3604	3030	946	3784
2806	901,2	3604,8	3031	946,2	3784,8
2807	901,4	3605,6	3032	946,4	3785,6
2808	901,6	3606,4	3033	946,6	3786,4
2809	901,8	3607,2	3034	946,8	3787,2
2810	902	3608	3035	947	3788
2811	902,2	3608,8	3036	947,2	3788,8
2812	902,4	3609,6	3037	947,4	3789,6
2813	902,6	3610,4	3038	947,6	3790,4
2814	902,8	3611,2	3039	947,8	3791,2

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Uplink CH (TX)	Freq (MHz)	VCO (MHz)	Downlink CH (RX)	Freq (MHz)	VCO (MHz)
2815	903	3612	3040	948	3792
2816	903,2	3612,8	3041	948,2	3792,8
2817	903,4	3613,6	3042	948,4	3793,6
2818	903,6	3614,4	3043	948,6	3794,4
2819	903,8	3615,2	3044	948,8	3795,2
2820	904	3616	3045	949	3796
2821	904,2	3616,8	3046	949,2	3796,8
2822	904,4	3617,6	3047	949,4	3797,6
2823	904,6	3618,4	3048	949,6	3798,4
2824	904,8	3619,2	3049	949,8	3799,2
2825	905	3620	3050	950	3800
2826	905,2	3620,8	3051	950,2	3800,8
2827	905,4	3621,6	3052	950,4	3801,6
2828	905,6	3622,4	3053	950,6	3802,4
2829	905,8	3623,2	3054	950,8	3803,2
2830	906	3624	3055	951	3804
2831	906,2	3624,8	3056	951,2	3804,8
2832	906,4	3625,6	3057	951,4	3805,6
2833	906,6	3626,4	3058	951,6	3806,4
2834	906,8	3627,2	3059	951,8	3807,2
2835	907	3628	3060	952	3808
2836	907,2	3628,8	3061	952,2	3808,8
2837	907,4	3629,6	3062	952,4	3809,6
2838	907,6	3630,4	3063	952,6	3810,4
2839	907,8	3631,2	3064	952,8	3811,2
2840	908	3632	3065	953	3812
2841	908,2	3632,8	3066	953,2	3812,8
2842	908,4	3633,6	3067	953,4	3813,6
2843	908,6	3634,4	3068	953,6	3814,4
2844	908,8	3635,2	3069	953,8	3815,2
2845	909	3636	3070	954	3816
2846	909,2	3636,8	3071	954,2	3816,8
2847	909,4	3637,6	3072	954,4	3817,6
2848	909,6	3638,4	3073	954,6	3818,4
2849	909,8	3639,2	3074	954,8	3819,2

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Uplink CH (TX)	Freq (MHz)	VCO (MHz)	Downlink CH (RX)	Freq (MHz)	VCO (MHz)
2850	910	3640	3075	955	3820
2851	910,2	3640,8	3076	955,2	3820,8
2852	910,4	3641,6	3077	955,4	3821,6
2853	910,6	3642,4	3078	955,6	3822,4
2854	910,8	3643,2	3079	955,8	3823,2
2855	911	3644	3080	956	3824
2856	911,2	3644,8	3081	956,2	3824,8
2857	911,4	3645,6	3082	956,4	3825,6
2858	911,6	3646,4	3083	956,6	3826,4
2859	911,8	3647,2	3084	956,8	3827,2
2860	912	3648	3085	957	3828
2861	912,2	3648,8	3086	957,2	3828,8
2862	912,4	3649,6	3087	957,4	3829,6
2863	912,6	3650,4	3088	957,6	3830,4

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9 — Service information differences between RM-505 and RM-506

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RM-506 product data

RM-506 is a 2G variant of the Nokia N97. The key product data differences between the RM-506 (2G) and RM-505 (3G) are described below.

Connectivity

Table 18 Remote connectivity

Operating bands	RM-506: EGSM 850/900/1800/1900 (no WCDMA/ HSDPA)
WLAN	WLAN RM-506: No WLAN

Sales package

- Transceiver RM-506
- Battery (BL-4L/1500mAh)
- USB charger (AC-10)
- Stereo headset (HS-45) with remote control plug (AD-54)
- Micro USB connectivity cable (CA-101D)
- Mini-DVD
- Short user guide

Product and module list

Module name	Type code	Notes
System/RF Module	2VA	Main PWB with components for RM-506

BB troubleshooting

PWB markings in RM-506 and RM-505

Mechanically RM-506 and RM-505 are identical and thus the HW differences are noticeable only by taking a closer look at the PWB. As illustrated in the figure below, the markings on the PWB enable quick differentiation between the two variants.

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Figure 92 PWB markings in RM-506 (2G) and RM-505 (3G)

RF troubleshooting

RM-506 RF block

As RM-506 is a 2G variant of the Nokia N97, it has no WCDMA RF components in the RF block. It also has no WLAN module on the PWB.

The following WCDMA RF components are not assembled in RM-506:

- N7540 WCDMA PA
- Z7540 WCDMA 2100 duplexer

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- Z7541 WCDMA 1900 duplexer
- Z7542 WCDMA 900 duplexer
- Z7543 WCDMA 1900/2100 TX SAW
- Z7544 WCDMA 900 TX SAW

Z7522 GSM 900/1900 Rx filter GSM RF component is additionaly assembled in RM-506.

RM-505 RF block

Figure 2 below illustrates the RF block component of RM-505.

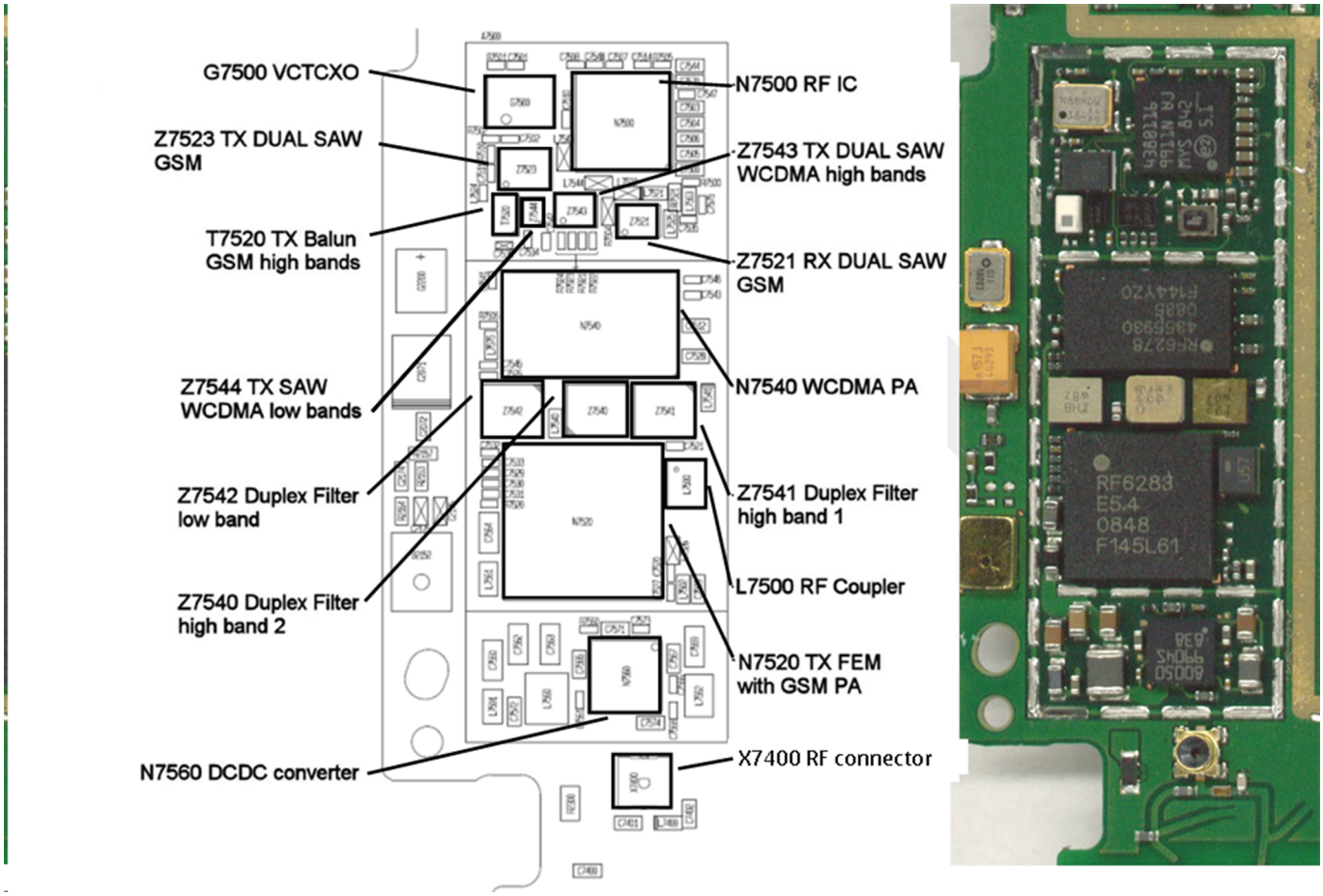

Figure 93 RM-505 RF key components

RM-506 RF block

Note: The attenuation values for the SA-XXX RF coupler as well as the TX power level tuning targets are the same for the GSM bands in both RM-506 and RM-505.

The graphics below illustrate the differences in RF block component placement between RM-506 and RM-506.

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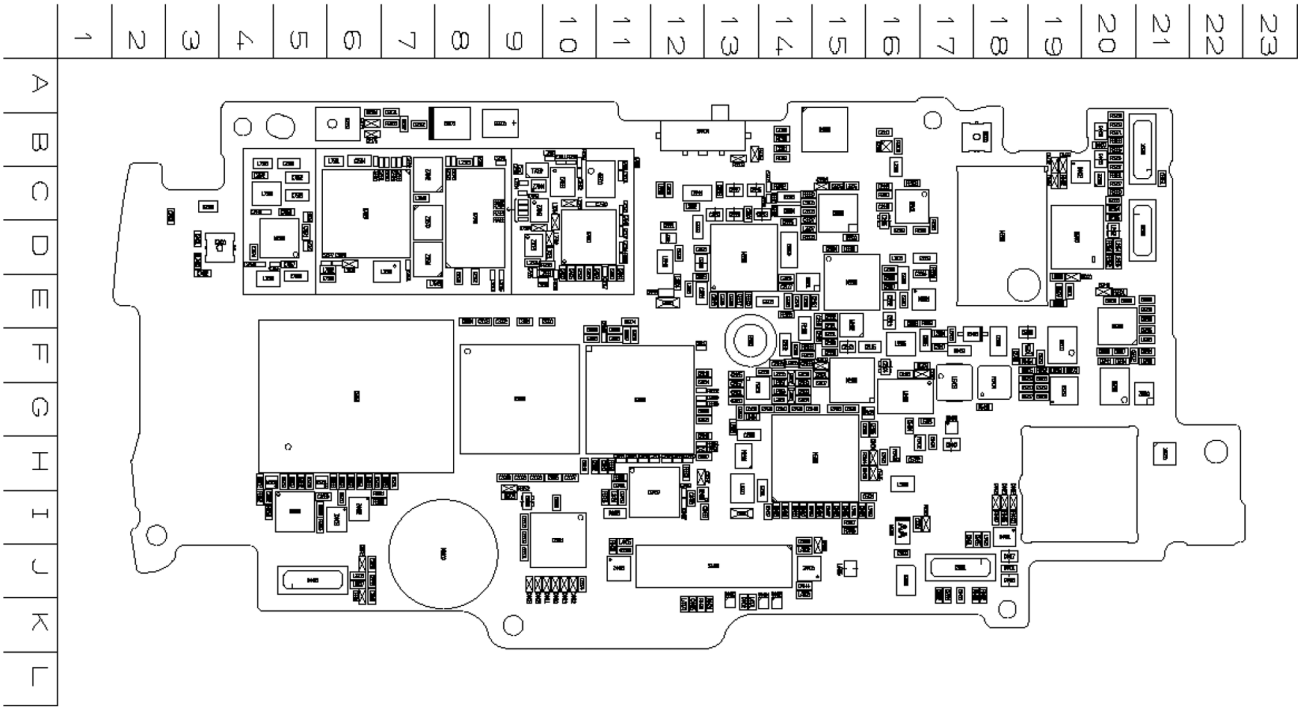
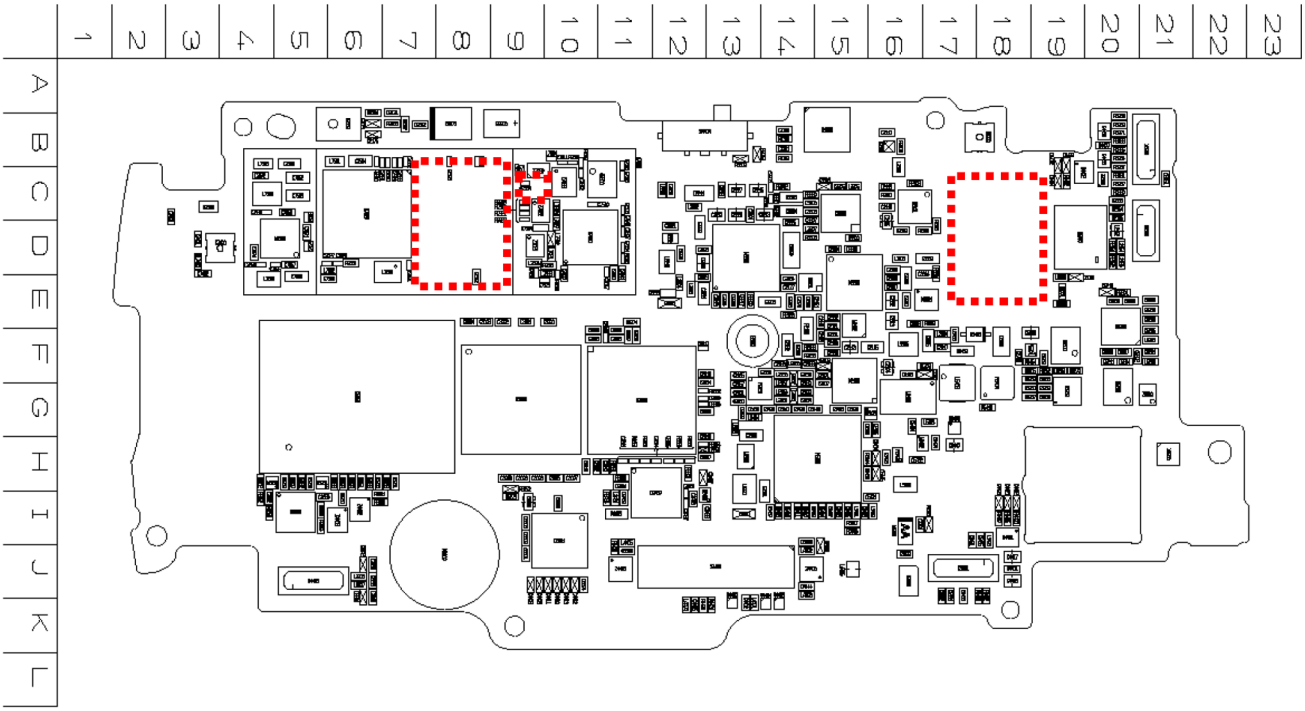
RM-505



RM-506



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Glossary

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A/D-converter	Analogue-to-digital converter
ADC	Analogue-to-digital converter
ALS	Ambient light sensor
ARM	Advanced RISC Machines
ASIC	Application Specific Integrated Circuit
ASIP	Application Specific Interface Protector
B2B	Board to board, connector between PWB and UI board
BA	Board Assembly
BB	Baseband
BCM2048	Bluetooth module made by BROADCOM
BSI	Battery Size Indicator
BT	Bluetooth
CBus	MCU controlled serial bus connected to UPP_WD2, UEME and Zocus
CCP	Compact Camera Port
CDMA	Code division multiple access
CMOS	Complimentary metal-oxide semiconductor circuit (low power consumption)
COG	Chip on Glass
CPU	Central Processing Unit
CSD	Circuit-switched data
CSR	Cambridge silicon radio
CSTN	Colour Super Twisted Nematic
CTSI	Clock Timing Sleep and interrupt block of Tiku
CW	Continuous wave
D/A-converter	Digital-to-analogue converter
DAC	Digital-to-analogue converter
DMA	Direct memory access
DP	Data Package
DPLL	Digital Phase Locked Loop
DSP	Digital Signal Processor
DTM	Dual Transfer Mode
DtoS	Differential to Single ended
EDGE	Enhanced data rates for global/GSM evolution
EGSM	Extended GSM
EM	Energy management
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference

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ESD	Electrostatic discharge
FCI	Functional cover interface
FPS	Flash Programming Tool
FR	Full rate
FSTN	Film compensated super twisted nematic
GMSK	Gaussian Minimum Shift Keying
GND	Ground, conductive mass
GPIB	General-purpose interface bus
GPRS	General Packet Radio Service
GSM	Group Special Mobile/Global System for Mobile communication
HSDPA	High-speed downlink packet access
HF	Hands free
HFCM	Handsfree Common
HS	Handset
HSCSD	High speed circuit switched data (data transmission connection faster than GSM)
HW	Hardware
I/O	Input/Output
IBAT	Battery current
IC	Integrated circuit
ICHAR	Charger current
IF	Interface
IHF	Integrated hands free
IMEI	International Mobile Equipment Identity
IR	Infrared
ISA	Intelligent software architecture
JPEG/JPG	Joint Photographic Experts Group
LCD	Liquid Crystal Display
LDO	Low Drop Out
LED	Light-emitting diode
LPRF	Low Power Radio Frequency
MCU	Micro Controller Unit (microprocessor)
MCU	Multiport control unit
MIC, mic	Microphone
MIDP	Mobile Information Device Profile
MIN	Mobile identification number
MIPS	Million instructions per second

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MMS	Multimedia messaging service
NFC	Near field communication
NTC	Negative temperature coefficient, temperature sensitive resistor used as a temperature sensor
OMA	Object management architecture
OMAP	Operations, maintenance, and administration part
Opamp	Operational Amplifier
PA	Power amplifier
PDA	Pocket Data Application
PDA	Personal digital assistant
PDRAM	Program/Data RAM (on chip in Tiku)
Phoenix	Software tool of DCT4.x and BB5
PIM	Personal Information Management
PLL	Phase locked loop
PM	(Phone) Permanent memory
PUP	General Purpose IO (PIO), USARTS and Pulse Width Modulators
PURX	Power-up reset
PWB	Printed Wiring Board
PWM	Pulse width modulation
RC-filter	Resistance-Capacitance filter
RF	Radio Frequency
RFBUS	Serial control Bus For RF
RSS	Web content Syndication Format
RSSI	Receiving signal strength indicator
RST	Reset Switch
RTC	Real Time Clock (provides date and time)
RX	Radio Receiver
SAW filter	Surface Acoustic Wave filter
SDRAM	Synchronous Dynamic Random Access Memory
SID	Security ID
SIM	Subscriber Identity Module
SMPS	Switched Mode Power Supply
SNR	Signal-to-noise ratio
SPR	Standard Product requirements
SRAM	Static random access memory
STI	Serial Trace Interface

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SW	Software
TCP/IP	Transmission control protocol/Internet protocol
TCXO	Temperature controlled Oscillator
TX	Radio Transmitter
UART	Universal asynchronous receiver/transmitter
UI	User Interface
UPnP	Universal Plug and Play
USB	Universal Serial Bus
VBAT	Battery voltage
VCHAR	Charger voltage
VCO	Voltage controlled oscillator
VCTCXO	Voltage Controlled Temperature Compensated Crystal Oscillator
VCXO	Voltage Controlled Crystal Oscillator
Vp-p	Peak-to-peak voltage
VSIM	SIM voltage
WCDMA	Wideband code division multiple access
WD	Watchdog
WLAN	Wireless local area network
XHTML	Extensible hypertext markup language

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